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ABSTRACT

Nine case studies of effective district and school-level programs for serving highly able, disadvantaged students in mathematics and science are presented. Case study sites included: Baltimore Polytechnic Institute, Baltimore, Maryland; Challenge '85, Salina, Oklahoma; Gifted and Talented Program, James A. Garfield High School, Los Angeles, California; Richmond Community High School, Richmond, Virginia; Detroit Area Pre-College Engineering Program, Detroit, Michigan; Gifted and Talented Program, Chicago Public Schools, Chicago, Illinois; Encendiendo Una Llama, Hartford, Connecticut; Potentially Gifted Minority Student Project, West Palm Beach, Florida; and Training of Elementary School Teachers in Mathematical Thinking, Fort Worth, Texas. Sites were selected on the basis that they served a high percentage of disadvantaged students, used multiple measures to identify promising students, employed successful curricular or administrative programs, and showed evidence of effectiveness. The programs also showed potential for being transferred to another educational setting, or contained a component that could be adopted by others. An attempt was made to select sites that were geographically diverse and included both urban and rural settings. The case studies address the following program functions: program development, program operation, student identification and selection process, program staffing, support services, funding and administration, program impact, and transferability. (JDD)

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NO GIFT WASTED:

Effective Strategies for Educating Highly Able, Disadvantaged Students in Mathematics and Science

Volume II: Case Studies

Prepared Under Contract by:

COSMOS Corporation
Washington, D.C.

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U.S. DEPARTMENT OF EDUCATION • OFFICE OF PLANNING, BUDGET & EVALUATION

**NO GIFT WASTED: EFFECTIVE STRATEGIES FOR EDUCATING
HIGHLY ABLE, DISADVANTAGED STUDENTS IN MATHEMATICS
AND SCIENCE (VOLUME II: Case Studies)**

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PREFACE

This document is Volume II of the final report of a study that was conducted by COSMOS Corporation during 1987-1988 for the U.S. Department of Education's Office of Planning, Budget and Evaluation. This volume presents nine case studies of effective district-wide strategies and school-level programs for serving highly able, disadvantaged students in mathematics and science. Volume I describes the general findings from an analysis of district and school efforts aimed at developing economically disadvantaged students' academic skills and creative talents.*

The impetus for the study was the U.S. Department of Education's desire to understand the efforts that are being made by school districts to educate their most able disadvantaged students and to prepare them for postsecondary education. The Department also was interested in learning about ways in which funds awarded under Title II of the 1984 Education for Economic Security Act (P.L. 98-377) have been used to foster the academic development of students in mathematics, science, and the critical foreign languages.

During the course of the study, data were collected from 29 school districts or schools located throughout the country. Telephone interviews were conducted with representatives from each of these sites, which offered a variety of instructional programs for highly able students. Case studies were conducted at nine sites. Thus, the study is based upon a wealth of information about diverse efforts that are being undertaken to provide disadvantaged students with educational opportunities.

Our data collection activities would not have been possible without the cooperation of the representatives from each of the sites examined in the study. Their willingness to describe their efforts and share with us their successes and frustrations in providing quality programs is deeply appreciated. Finally, our gratitude is expressed to those who organized our case study visits, and to the faculty, staff, students, parents, community and school board members who graciously met with us and provided us with detailed information about program operations.

At critical points throughout the study we benefited from the guidance of the staff of the U.S. Department of Education, Office of Planning, Budget and Evaluation. Arthur Kirschenbaum, our project

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monitor for the study, provided advice on each of the study's phases. We wish to acknowledge his support throughout our effort. Other members of the U.S. Department of Education who provided thoughtful insights are: Alan Ginsburg, Valena Plisko, Nina Winkler, Carol Chelemer, Alan Schmieder, Charles Lovett, and Joanne Wiggins.

Special thanks are extended to the study's three advisers: William G. Durden, The Johns Hopkins University; Paula M. Olszewski-Kubilius, Northwestern University; and Patricia Bruce Mitchell, National Association of State Boards of Education. Their assistance in identifying effective district and school programs and in reviewing all study documents has been invaluable. Finally, we wish to thank the numerous researchers and practitioners who provided us with nominations of promising approaches for serving highly able, disadvantaged students.

The members of the COSMOS team who conducted this study are: Judith A. Alamprese, the principal investigator; Wendy J. Erlanger and Nancy Brigham, who joined Judith Alamprese in the study's design and data collection activities; Joanne Capper, who served as a case study site visitor; and Robert K. Yin, who provided guidance as the study's corporate reviewer.

Finally, while we are thankful for the assistance provided by others, the authors alone are responsible for the contents of this final report.

Judith A. Alamprese
Wendy J. Erlanger
Nancy Brigham

COSMOS Corporation

CONTENTS

PREFACE	iii
Section	
I. INTRODUCTION	1
A Study of Highly Able, Disadvantaged Students	1
The Case Studies	1
II. BALTIMORE POLYTECHNIC INSTITUTE	5
Introduction	5
Historical Development	5
The Poly Program	6
Student Selection Process	12
Program Staffing	13
Funding and Administration	13
Impact	15
Program Transferability	16
III. CHALLENGE '85 (Salina, Oklahoma)	17
Introduction	17
Development of Challenge '85	17
Program Operation	20
Program Funding and Administration	22
Impact of Challenge '85	24
Program Transferability	25
IV. JAMES A. GARFIELD HIGH SCHOOL'S GIFTED AND TALENTED EDUCATION PROGRAM (Los Angeles, California)	27
Introduction	27
Development of a District Strategy	27
Student Identification Process	28
GATE Program Components	29
Program Staffing	32
Funding and Administration	33
Program Impact	34
Program Transferability	36

V. RICHMOND COMMUNITY HIGH SCHOOL	37
Introduction	37
Creation of a District Strategy	37
The RCHS Program	38
Support Services	44
Parent Involvement	44
Community Involvement	45
Staffing	45
Funding	46
Administration and District Coordination	46
Program Impact	47
Program Transferability	48
VI. DETROIT AREA PRE-COLLEGE ENGINEERING PROGRAM	49
Introduction	49
Development of DAPCEP	49
The DAPCEP Program	51
Parent Involvement	56
Program Administration and Staff	56
Funding	57
District and State Context	58
DAPCEP's Impact	58
Program Transferability	60
VII. CHICAGO PUBLIC SCHOOLS GIFTED AND TALENTED PROGRAM	63
Introduction	63
Development of System-Wide Strategy	64
The Gifted and Talented Program	66
Support Services	71
Parent Involvement	71
Program Funding and Administration	72
Program Impact	73
Program Transferability	76
VIII. ENCENDIENDO UNA LLAMA (Hartford, Connecticut)	77
Introduction	77
Development of a District Strategy	77
Encendiendo Una Llama	78
Parent Involvement	82
Program Staffing	83
Funding and Administration	83
Articulation	84
Program Impact	85
Program Transferability	85

IX. THE POTENTIALLY GIFTED MINORITY STUDENT PROJECT (West Palm Beach, Florida)	87
Introduction	87
Development of District Strategy	87
The Potentially Gifted Project	88
Program Staffing	92
Parent Involvement	93
Funding and Program Administration	93
Impact of PGP	94
Program Transferability	95
X. TRAINING OF ELEMENTARY SCHOOL TEACHERS IN MATHEMATICAL THINKING (Fort Worth, Texas)	97
Introduction	97
Historical Development	97
Program Operation	100
Teacher Selection	102
Program Staffing	103
Funding and Administration	103
Program Impact	104
Program Transferability	105
REFERENCES	107

FIGURES

1. Baltimore Polytechnic Institute	8
2. DAPCEP Pre-College Engineering Enrichment Courses	52

TABLES

1. Overview of Nine Case Study Sites	3
2. Comparison of Challenge '85 and Other High School Students' Participation in Higher Education or Training 1985-1988.....	24
3. Comparison of Student Enrollments in Mathematics and Science Classes	35
4. Profile of DAPCEP Graduates Pursuing Post-Secondary Study in Science and Mathematics	59
5. ITBS Mathematics Scores of Regular and Gifted Students Spring 1987	75
6. Comparison of Academic Center and High School Students Who Score Three or Higher on AP Exams: 1986-87	75

I. INTRODUCTION

A Study of Highly Able, Disadvantaged Students

The education reform movement in this country increasingly has focused attention on the needs of economically disadvantaged students. Of particular concern is the effort that is being made to provide our most promising disadvantaged students with opportunities to develop their academic potential, especially in the areas that affect our nation's ability to compete internationally in a global economy.

In the light of this concern, the U.S. Department of Education, Office of Planning, Budget and Evaluation funded COSMOS Corporation in 1987 to investigate the efforts that are being made by school districts and schools to serve highly able, disadvantaged students. The U.S. Department of Education was interested in understanding both district-wide strategies and individual school practices that have been effective in reaching disadvantaged students and in fostering their achievement, particularly in mathematics, science, and the critical foreign languages--Japanese, Chinese, and Russian.

In the study, the case study method was used to document the operation of nine model programs, and the lessons learned from the implementation of these efforts for educating highly able, disadvantaged students. This volume presents case studies of the nine programs, which describe the efforts being made to develop students' abilities in mathematics and science. A companion volume discusses the critical issues that should be considered in nurturing the development of highly able, disadvantaged students (Alamprese and Erlanger, 1988).

The Case Studies

The nine district and school programs presented in this volume illustrate a variety of approaches for serving highly able, economically disadvantaged students. The programs, identified through a national search, were selected according to four criteria: 1) percentage of economically disadvantaged students; 2) use of multiple measures in identifying highly able, disadvantaged students; 3) type of program--

either a curricular practice or administrative arrangement; and 4) evidence of effectiveness. Specifically, each case study site had to meet the following conditions:

1. Percentage of economically disadvantaged students: a program had to be in a school district in which at least 30 percent of its students are eligible for the federal school lunch program;
2. Use of multiple measures: a program had to identify highly able, disadvantaged students using at least one standardized measure of student achievement or intelligence, and at least one other indicator of student ability, such as assessment of classroom performance or a teacher's recommendation;
3. Type of program: a program had to be either a curricular practice--accelerated curricula, enrichment activities, or an administrative arrangement--early identification procedures, inservice education programs; and
4. Evidence of effectiveness: a program had to present evidence of being effective in at least one of the following: a) increasing student achievement; b) increasing student enrollments in mathematics, science, or the critical foreign languages; or c) encouraging students to pursue higher education and/or careers in one of these fields.

In addition to meeting the study's four criteria, a program selected as a case study site had to have the potential for being transferred to another educational setting, or have a component that could be adopted by others. Finally, in selecting the nine sites, an attempt was made to have sites that were geographically diverse and included both urban and rural settings. An overview of the nine case study sites is presented in Table 1. As is seen in the table, the nine programs address either mathematics, science, or both disciplines.

Table 1
OVERVIEW OF NINE CASE STUDY SITES

Site	Substantive Focus	Practice Type	Target Pop.	Geog. Location	Area Served	%Econ. Disad. Prog./Dist.	No. of Select. Crit. Met.	Effect. Data
Baltimore Polytechnic Institute Baltimore, MD	M,S, Engin.	Magnet School (Curric.)	Students: Grades 9-12	NE	Urban	33%/51%	3	Post Program Participat.
Challenge '85 Salina, OK	M,S	Curric.	Students: Grades 11-12	MW	Rural	45%/50%	2	Post Program Participat.
Gifted & Talented Program James A. Garfield High School Los Angeles, CA	M,S	Curric.; Counseling Component; Under-Achiev. Gifted Track	Students: Grades 10-12	W	Urban	98%/46%	2	Student Achiev.
Richmond Community High School Richmond, VA	M,S	Alternat. School (Curric.)	Students: Grades 9-12	SE	Urban	70%/49%	4	Post Program Participat.
Detroit Area Pre-College Engineering Program (DAPCEP) Detroit, MI	M,S, Engin.	Mid. Sch. Curr.; Sec. Sch. Enrich and Summer Program	Students: Grades 7-12	MW	Urban	45%/41%	4	Post Program Participat.
Gifted & Talented Program Chicago Public Schools Chicago, IL	M,S	Curric.; Museum Collabor.; ID/Tracking	Students: Grades K-12	MW	Urban	52%/68%	4	Student Achiev.
Encendiendo Una Llama Hartford, CT	M,S	Curric.; Mentorships; Enrichment;	Students: Grades K-12	NE	Urban	80%/45%	3	Post Program Participat.
Potentially Gifted Minority Student Project W. Palm Beach, FL	M	Curric. w/Enrich.	Students: Grade 4	SE	Suburban/ Rural	80%/30%	2	Student Achiev. Post Program Participat.
Training of Elem. School Teachers in Mathematical Thinking Fort Worth, TX	M	Inservice Training	Math. Teachers: Grades K-6	SW	Urban/ Suburban	N.A./60%	2	Changes in Teachers' Attitudes & Abilities

While an attempt was made to identify a program in the critical foreign languages, none could be found that met all of the study's criteria.

Although the nine programs vary in terms of programmatic philosophy, program type, grade level of students served, and organizational structure, all have been effective in providing opportunities for disadvantaged students to develop their skills and potential. The case studies presented in this volume attempt to illustrate the ways in which district-wide efforts as well as school-level practices address the needs of disadvantaged students in terms of the following core set of functions: 1) development of the program, 2) program operation, 3) student identification and selection process, 4) program staffing, 5) support services, 6) funding and administration, 7) program impact, and 8) transferability. The case studies, which discuss each of these functions, are ordered in terms of the grade level of the students they serve, beginning with secondary-level programs.

While the case studies reflect only a small number of efforts that are underway in this country to serve highly able, disadvantaged students, it is hoped that the processes described in the cases can be used by school administrators and staff to enhance their strategies for addressing these students' needs.

II. BALTIMORE POLYTECHNIC INSTITUTE

Introduction

Baltimore Polytechnic Institute (Poly) is a specialized high school in northwest Baltimore, Maryland for highly able students in grades 9-12, 40 percent of whom are economically disadvantaged. Poly offers a structured mathematics, science, and engineering curriculum, as well as a variety of support services. As one of four citywide high schools in the Baltimore City Public Schools that admit students on a competitive basis, Poly provides a concentrated course of study designed to prepare students for admission into institutions of higher education.

Historical Development

Poly always has had a specialized curriculum. Its founder, Joshua Plaskitt, petitioned city authorities in 1883 to establish an engineering school because a local committee had found that increased instruction in industrial arts was needed in the community. With four faculty members, the Baltimore Manual Trading School opened its doors in 1884 to 25 boys. Initially, the curriculum emphasized mechanical subjects, but was revised and strengthened by the school's later principals. Although supplementary courses have been added over time, the focus of the curriculum and the need of the community has remained the same--to develop students' skills in mathematics, science, and engineering. In addition to curriculum modifications, other changes have occurred at Poly, including the admission of female students beginning in 1974 (Griswold, 1984).

During the early 1970s, families in the Baltimore community became dissatisfied with the general academic curriculum offered at the comprehensive high schools and expressed a desire for more specialized instruction in specific content areas. To satisfy this need, the Baltimore City Public Schools established specialized or selective content schools, of which Poly was an existing example. Over time, three other citywide schools were established to provide specialized programs in

the arts, social sciences, and vocational education. The district's comprehensive high schools continued to offer a general curriculum to students.

In the mid-1970s, Baltimore's population began to change. White families began to move to the suburbs, while a substantial number of minority families remained in the city. This population shift also affected the district's school population. Up to the mid-1970s, the majority of Poly's students were white; by the late 1970s, a significant proportion of the school's students were black. Even though its student population changed over time, Poly neither has readjusted its standards nor altered its curriculum.

Currently, the student body is 65 percent minority (black, hispanic, Asian, and Native American). Although 40 percent of Poly's 1,600 students participate in the federal school lunch program, 50 percent are eligible. Formerly an all male school, one third of Poly's students currently are female.

The Poly Program

Poly students participate in a highly structured academic program. In keeping with its original plan, Poly provides a technical education that prepares students for entering more specific training courses for the engineering and science profession or its associated technical fields. The school also attempts to develop students' logic and skills in mathematics and computer programming, so that they can use these skills to enhance problem solving in all disciplines. Poly helps students develop the ability to read, write, and speak effectively--whether in English or a foreign language. Finally, the school attempts to prepare students--through guidance and support services--to select the next appropriate educational or career option. College admissions are emphasized strongly by Poly staff throughout a student's high school career, and especially in his/her senior school year.

In order to achieve these objectives, the school has implemented the following key program components: 1) a rigorous mathematics, science, and engineering curriculum; and 2) a variety of support services

for economically disadvantaged, highly able students. In addition, external alliances--involving parents, alumni, and community representatives--have been formed to support the school and its program. Each of these components is described below.

Curriculum. Poly's highly structured curriculum in mathematics, science, and engineering is divided into two tracks: an advanced college preparatory (A) track, and a college preparatory (B) track. Both tracks are specialized in that they prepare students for entrance into engineering and science colleges or into technical careers. Presented in Figure 1 is the list of course requirements for the A and B tracks.

The A track covers the high school curriculum in three years, leaving the last year for college course work. The B track is an accelerated college-preparatory program with less college-level course work. In their senior year, both A and B track students select either a science or engineering option and enroll in all the required courses, including a major independent research project or practicum. All Poly students are required to enroll in four years of mathematics and four years of science, which is an increase over the state's requirement of three years of mathematics and two years of science and the district's requirement of three years of each.

Although Advanced Placement (AP) courses are not offered at Poly due to a highly structured, traditional curriculum in scientific and technical fields, both A and B track students may take the AP exams. The school administers the exams when a minimum number of students requests to take them. Formal exams lasting three hours are held in all major subjects at the end of each semester. The exam grade is averaged with the two quarter grades for the final mark of that semester.

In order to provide students with frequent feedback about their academic performance, Poly distributes an informal report card--marked X (good), Y (fair), or Z (failing)--at the middle of each quarter, in addition to the formal quarterly report cards required by the city school system. Both informal and formal report cards must be signed by parents (Baltimore Polytechnic Institute, 1987). In order to be

Figure 1

BALTIMORE POLYTECHNIC INSTITUTE

A COURSE CURRICULUM9th Grade

English
 Algebra I or II
 Geometry
 Biology
 Foreign Language I or II
 American Government
 Urban Growth
 Mechanical Drawing
 Shop Practice (Wood & Sheet Metal)
 Computer Programming I
 Physical Education

11th Grade

English III
 Advanced Algebra
 Analytic Geometry
 Calculus I
 Physics
 Foreign Language III or IV
 U.S. History
 Design
 Practice (Machine Shop)
 Computer Programming II

10th Grade

English II
 Algebra II or Modern Algebra
 Trigonometry
 Chemistry
 Foreign Language II or III
 World History
 Mechanical Drawing
 Practice (Hot Metal)
 Physical Education

12th Grade

English IV
 Calculus II
 Drama

Engineering Option

Thermodynamics
 Electricity
 Mechanics
 Engineering Practicum
 Architectural Drawing

Science Option

Biology II
 Organic Chemistry
 Biochemistry
 Science Practicum

Choice of: Survey of Western
 Civilization or

Descriptive Geome-
 try and Surveying

Figure 1, (Continued)

B COURSE CURRICULUM9th Grade

English I
 Algebra I or II
 Science Laboratory Techniques
 Foreign Language I
 American Government
 Urban Growth
 Mechanical Drawing
 Shop Practice (Wood & Sheet Metal)
 Writing Lab
 Computer Programming I
 Physical Education

11th Grade

English III
 Algebra II or Advanced Algebra
 Trigonometry
 Physics
 U.S. History
 Design
 Practice (Machine Shop)
 Computer Programming II
 Choice of: Foreign Language III
 or
 Mechanical Drawing
 and Practice (Wood)

10th Grade

English II
 Geometry
 Biology
 Foreign Language II
 World History
 Mechanical Drawing
 Shop Practice (Hot Metal)
 Physical Education

12th Grade

English IV
 Precalculus or Calculus I
 Chemistry
 Drama

Engineering Option

Electricity
 Mechanics
 Engineering Practicum

Science Option

Biology II
 Science Practicum

Choice of: Geography and
 Economics

or

Architectural
 Drawing and
 Surveying

retained in the program, a Poly student may fail no more than two credits each year.

One unique feature of Poly's curriculum, in both the A and B tracks, is that classes are scheduled in double or block periods that allow for the practice of theoretical material. The school adopted block scheduling--as a distinct practice among district schools--so that engineering and science laboratories could be held following a class period of lecture and discussion. Poly's laboratories are equipped with science and computer equipment, as well as shop materials and supplies that students may use during the double class period of one hour and fifty minutes. Students are grouped together in the same classes on a semester schedule.

In addition to the strong emphasis on science and mathematics, the curriculum includes language arts and humanities courses. Students are required to take four years of English, three years of history, and at least one year of a foreign language (French, German, and Spanish are offered). Also, extracurricular activities--clubs, student government, athletics--are available to students. Twice a year (in January and June) all Poly students are required to participate in a Community Service Program, whereby they work at community sites of their choice for two full school days. In addition, through the Adopt-A-School Program, local firms sponsor field trips and send guest lecturers to Poly.

Support and Guidance. Given this demanding curriculum, a variety of support services are provided to Poly students. Many of the school's students require assistance in order to master the advanced, highly technical courses. Others need guidance balancing course work with after-school jobs. Some seek assistance in resolving family problems. Teachers, students, and counselors are available to provide support and guidance.

All teachers are required to post "coach class" time--either before or after school--one day a week. At this time, teachers provide one-on-one assistance to students in a particular content area.

The block scheduling creates comradeship among students who spend their entire day together, and formal and informal tutoring is common

among classmates. On an informal basis, one student may assist a group of students, or students within the same track may help one another. Also, a formal peer tutoring program is operated by the Peer Facilitators in the guidance office. This program provides a plan for students to work together in a one-on-one relationship.

Finally, the Guidance Department, staffed by full-time counselors, is available to students. Generally, the department provides academic (both high school and college) and vocational counseling, as well as assistance with social-emotional problems, on a group or individual basis. Students in each grade level meet individually with a counselor, who also has one or two scheduled group meetings with parents. A student can approach his/her counselor any time to discuss a problem without an appointment.

Counselors also assist parents in working with their children in the areas of college preparation or social and academic adjustment. Poly parents strongly support their children and the school, as is evident from parental participation in alliances which have formed recently to sustain and strengthen the program.

External Alliances. Three groups--a Board of Overseers, the Poly Parents' Association, and the Polytechnic Alumni Association--work together in support of Poly. A 25-member Board of Overseers, composed of alumni, parents, faculty, and community representatives, was formed in 1984 to generate community interest in the school. The board has created a foundation--the Baltimore Polytechnic Institute Foundation--to raise funds for the school and to present policy recommendations to the district's School Board.

The parents' association attempts to stimulate parents' participation in school affairs. With a core group of 15 members, the association meets monthly, publishes a newsletter, and holds an annual conference night for parents and teachers.

The alumni association maintains contact with former Poly graduates and works with the Board of Overseers and the parent group to improve the school's program. One benefit of Poly's long history has

been the development of a loyal alumni group, who participate in school-sponsored career awareness activities.

Student Selection Process

The district begins the selection process for the competitive citywide schools during February of each year, when students interested in attending Poly or the other citywide schools submit an application to the district placement office. Selection is based upon an evaluation of three data sources: 1) grade point average (GPA), 2) attendance, and 3) achievement test data. All prospective students are required to take the California Achievement Test (CAT), with the exception of students from parochial schools, who take the Comprehensive Assessment Program (CAP) exam, and students from other private schools, who take the Education Records Bureau (ERB) exam. In order for a prospective Poly student to be eligible for the A track, he/she must have a GPA of 85, a 90 percent attendance rate, and score two grade levels above the average on the reading and mathematics portions of the CAT. For the B track, a prospective student must have a GPA of 80, a 90 per-cent attendance rate, and score one grade level above average on the CAT.

A composite score based upon the results of an analysis of the three data sources is computed by the district for each applicant. Students who select Poly as a first choice among the citywide schools are ranked in descending order by their composite scores (a student who fails to make the cut-off for the A track at Poly is automatically placed on the school's B track list). The composite score is computed by weighing the student's grade point average (GPA) twice as heavily as the student's standardized test scores and attendance (Luchs, 1986). In a few cases, when a student has high grades and unusually low test scores, a student may retake the CAT.

The district selects the top students, based upon a number designated by the school's director or principal. None of the selection is done according to race or sex. The district reviews admissions appli-

cations at three points in the spring, until all slots are filled. Admissions notifications are sent out to students in early April.

Program Staffing

Poly's student body is served by 70 instructors and five counselors. Due to Poly's highly specialized curriculum, most of the instructors have master's degrees in their subject areas. (The district requires that a teacher have an advanced degree if he/she has been teaching for ten years or more.) Poly instructors often are able to teach in more than one subject area. Teachers who are less knowledgeable about a subject or less experienced tend to seek help from their peers. A "buddy system" operates at Poly, whereby an experienced teacher assists another instructor through a team-teaching approach. Most of the school's faculty is tenured and faculty turnover and retirement has been infrequent. The district provides some staff development activities, including a one-day staff development session for mathematics teachers prior to the school year, and course offerings for science teachers at local universities.

Funding and Administration

Funding. Poly receives the majority of its funds from the school district. In 1986-87, the district was the school's primary means of financial support, contributing \$2.5 million. Another \$50,000 in contributions--from the Board of Overseers and private donors--supplemented the district total. Preceding years reflected a similar preponderance of district support. From 1983-84 to 1985-86, the district gave the school a total of \$7 million.

Administrative Structure and District Roles. John Dohler, Director of Baltimore Polytechnic Institute, is responsible for the overall operation of the school. He coordinates the academic program, with the assistance of three deans--a dean of Technical Studies, a dean of Humanities, and a dean of Student Affairs.

At the district level, various staff have monitoring responsibilities for Poly's program. The executive director of the district's Di-

vision of Secondary Education meets with Dohler and all of the high school principals once a month. The mathematics, science, and foreign language curriculum supervisors for the district contact Poly's and the other high schools' department chairpersons weekly and the deans monthly. In addition to district staff involvement with school operations, the district collects the following data annually: pupil attendance; numbers of students graduating in each track; annual report of financial aid received by Poly graduates; summary of graduate information (financial aid, special recognition); and summary of ninth grade school performance (standardized test scores and attendance).

The state mandates testing of students in grade 9 in the following competency areas: basic skills (reading, writing, mathematics), and citizenship. The district requires that students pass an additional reading proficiency test. In order to graduate, a Poly student must perform satisfactorily on the above tests plus earn a minimum number of credits in various content areas, as determined by the state (Division of Secondary, Vocational, Adult and Community Education, 1986).

While the state mandates testing and graduation requirements, the district determines budget and staff allocations, and book adoptions. Funds for materials, equipment, and supplies (not including books or maintenance) are calculated on a per pupil basis; in FY 88, this amount was \$25 per pupil. Three and one-half years ago the district converted to school-site budgeting, in which each school site principal now has responsibility for administering the school's budget. In the personnel area, the district continues to mandate staff ratios, which is a thirty to one student-teacher ratio. Book adoptions for the various subject areas occur on a cyclical basis, every five years.

The context for these district activities is a state that does not mandate gifted and talented education. Nevertheless, the state recognizes that "a gifted and talented child needs services beyond that normally provided by regular school programs in order to develop his potential" (Sections 8201 and 8202 of the Annotated Code of Maryland). Each of the twenty-four different local education agencies offers a variety of programs for Maryland's 56,000 highly able students in

grades K-12. The state suggests guidelines for local program development in six areas: identification, instructional program components, teacher selection, staff development, program management, and evaluation. Also, the state will provide technical assistance in any of these areas. Finally, the state operates a Summer Centers Program for 2,600 highly able students, a small portion of whom are Poly students. Fourteen different cooperative programs with local colleges and universities, businesses, and cultural institutions offer courses in every major content area, including mathematics, science, and technology.

The Baltimore City School District has a limited program for highly able students. The district's gifted and talented program at the elementary level is a pull-out program that ends at grade 5. Advanced academies serve students in grades 6-8; no one separate district-sponsored gifted program exists at the high school level, although honors, accelerated, and AP classes are offered.

All Baltimore's citywide schools--including Poly--aggressively recruit the top students at the middle school level. The Poly student body comes from 60 different feeder schools--public, private, and parochial. Once accepted at Poly, students tend to complete the four-year program and continue on to college. Colleges and universities come to the Poly campus to recruit its graduates.

Impact

Poly has been effective in encouraging students to pursue college careers upon completion of high school. A greater percentage of Poly graduates attend colleges and universities than do students from other high schools in the district serving high minority populations. In 1987, 85 percent of Poly graduates attended college, compared to an average of 20 to 25 percent of other high school students in the district. In 1986, 95 percent of Poly's graduates were accepted by four-year post-secondary institutions (about half of which were out of state), while 2 percent of Poly's graduates were accepted by two-year post-secondary institutions, (all of which were in-state). Colleges attended by 1986 graduates include Rensselaer Polytechnic Institute,

Drexel University, Lehigh University, Johns Hopkins University, Duke University, Brown University, Columbia University, Carnegie-Mellon University, and the Massachusetts Institute of Technology. Further, approximately 75 percent of Poly graduates pursue mathematics, science, or engineering in college.

Program Transferability

As a specialized, selective high school, Poly has been successful in attracting and retaining economically disadvantaged students who pursue a challenging academic program in mathematics, science, and engineering. Poly's selection procedures, as specified by the district, help to ensure that students admitted to the high school will have the skills required to master the accelerated curriculum.

In order to replicate Poly's academic and guidance components, either as a specialized school or as part of a multi-faceted secondary program, a number of conditions must be met. First, faculty qualified to teach the advanced mathematics, science, and engineering courses must be available. In addition, there is a need for a guidance staff experienced in serving highly able students, who come from a variety of educational and cultural backgrounds.

A second condition that is critical to the implementation of Poly's curriculum is the block scheduling. A school needs to have the flexibility to schedule lecture and laboratory classes in a continuous session, so that students can learn the application of theoretical material through laboratory exercises.

Third, laboratory and shop facilities must be available, in order to conduct the various science and engineering classes. For example, the shop classes use equipment that is not normally part of a district's supply of materials.

Finally, a district replicating the Poly model needs to be able to carry out a student selection process that assures that students have the capacities to complete the required curriculum.

III. CHALLENGE '85 (Salina, Oklahoma)

Introduction

Three rural school districts in eastern Oklahoma have joined together to offer an accelerated academic program for highly able students in grades 11 and 12. This program, Challenge '85, provides an opportunity for the districts' highest achieving students to enroll in a special half-day eleventh grade curriculum in advanced mathematics and science, computer science, and German. In addition, the program enables twelfth grade students to attend classes at local institutions of higher education and receive college credit for their academic work at these institutions.

Development of Challenge '85

During the early 1980s, three school districts in eastern Oklahoma--Salina, Chouteau, and Locust Grove--were suffering from an economic recession that hindered their abilities to provide high-quality educational programs to gifted students. The recession affected each district differently, depending on the demographic and cultural characteristics of their communities. Salina, the first white settlement in Oklahoma, is comprised of a substantial portion (25%) of Native Americans. Forty-five percent of the district's students are enrolled in the federal free or reduced lunch program. Most of Salina's residents are factory workers, farmers or ranchers. Chouteau is the home of the largest state-owned utility plant, which employs about 600 residents. Other Chouteau families, a number of whom are Amish (10%), are engaged in agriculture. Thirty-seven percent of this district's students are economically disadvantaged. Locust Grove, with almost half of its population being Native American (44%), is a community in which most of its residents work in neighboring towns, such as Tulsa or nearby Pryor. Forty-eight percent of Locust Grove students participate in the federal school lunch program.

Throughout the 1980s, all three districts worked to provide their students with a sound educational program. Nevertheless, advanced mathematics and science courses were not offered at the local high schools, and the selection of foreign language courses was limited. Consequently, the most talented high school students in the three districts were becoming uninterested in their course work and a number were leaving school early for other pursuits. Limited gifted programs were available, such as Salina's after-school gifted club for high school students. At the elementary and middle school levels, programs for gifted students were minimal. Of the three districts, Chouteau had the most extensive program--pull-out sessions one-half day per week, supplemented by enrichment activities at the middle school level.

Cecil Ford, superintendent of Salina Public Schools, realized that the area's brightest students needed a more challenging curriculum. In 1984, the Salina superintendent envisioned establishing a "Center for Excellence" where gifted high school students could take higher-level courses--such as calculus and advanced physics--that were not offered at the district high school, and could learn at a faster pace than their peers.

District Collaboration. In order to implement such a program, Salina's superintendent solicited the assistance of the two neighboring districts--Chouteau and Locust Grove. Each of the three districts was too small--in terms of number of gifted students and availability of funds--to undertake the initiative independently. The Salina superintendent thought that if all three districts pooled their resources and combined their gifted students in the same way that they cooperatively had served special education students, a successful accelerated academic program could be developed.

Ford discussed his plan with the superintendents of Chouteau and Locust Grove, who endorsed it enthusiastically. The three superintendents then presented the proposal to their respective school boards, who supported the idea and agreed to provide local funds for the project if outside funding could not be obtained (Garrett, n.d.).

The three superintendents worked together to develop the framework for the Center of Excellence, renamed it "Challenge '85," and presented their idea to the State Board of Education and the state legislature in Oklahoma City. The state legislators were in favor of the proposal, 'nce they viewed "small school cooperatives"--of which Challenge '85 was one example--as a viable alternative to school district consolidation.

Legislative Action. Pressure to consolidate school districts had surfaced often in Oklahoma's past and heightened considerably during the early 1980s. Two-thirds of the state's 611 school districts had average daily attendances of under 500, and consolidation was viewed as a means of pooling resources and cutting costs. In 1981, the pressure to consolidate intensified when the state increased the number of units required for high school graduation and set more stringent high school course prerequisites for admission to the state college and university systems. These requirements, which were to take effect during the 1986-87 school year, included two years of mathematics--instead of one--and two years of science--instead of one (State of Oklahoma Department of Education, 1987). However, many rural districts lacked the resources to meet the new state standards.

Given this dilemma, state legislators were seeking ways in which small rural districts could cooperate and pool resources without relinquishing their independent identities. Challenge '85 appeared to be a viable collaborative model. Further, the program also addressed the state's new academic requirements. The legislature responded positively and in 1985, appropriated \$1,000,000 to fund "small school cooperatives" in the state, \$50,000 of which supported Challenge '85. Small school cooperatives have remained a line item in the state budget since that time.

Creation of an Infrastructure. With legislative approval for co-operatives, the three districts moved ahead with the creation of Challenge '85. In 1985, each of the three school districts contributed \$6,000 to refurbish a three-room brick school building, owned by the Salina school district, to serve as the Challenge '85 center. Renova-

tions included the installation of laboratory facilities and computer equipment for Challenge '85 students. The districts' school boards agreed to share responsibility for selecting teachers, seeking additional resources, maintaining the facility, and providing transportation, equipment, and supplies. The boards delegated decision making to a separate Challenge '85 Governing Board, composed of three district superintendents, the high school principals and assistant principals. However, a decision regarding appropriation of funds would be referred back to the district school boards.

Program Operation

Once a building was obtained and the three districts agreed to joint management of the program, a curriculum was designed, staff were hired, and students were selected. As originally conceived, Challenge '85 became an accelerated mathematics/science/computer science center for highly able students in grades 11 and 12.

The overall goal of the program is to serve gifted students in three rural districts by providing them with an accelerated curriculum in a challenging academic environment. Specifically, Challenge '85 is designed to:

- o Increase students' motivation for learning;
- o Provide the academic skills and self-discipline that students need to be successful in college; and
- o Encourage students to prepare for careers in technical areas such as engineering, medicine, architecture, and computer-related professions (Salina Public Schools, December 1986).

Key Program Components. Crucial to the operation of Challenge '85 is the core curriculum, which includes physics, chemistry, trigonometry, and mathematics analysis (calculus). During their junior year, students take one semester of physics and one semester of advanced

chemistry. Also, students enroll in one semester of trigonometry and one semester of mathematics analysis. These courses are accelerated, since content areas normally covered in one year at the regular high school are covered in one-half year at Challenge '85.

All the mathematics and science courses in the Challenge '85 curriculum are taught five days a week, for approximately 45 minutes a day, from 9:30 a.m. to 11:30 a.m. The science courses include one laboratory period a week. Challenge '85 students attend classes at the Salina campus in the morning, and return to their home high schools in the afternoon for instruction in English, social studies, and the humanities.

In addition to the accelerated curriculum, an academic elective period is offered at the beginning of the day. During this time, students may study either German--offered via instructional television from the University of Oklahoma--or computer science. Students who participate in athletics or band at their home high schools do not enroll in an elective, but arrive at the Challenge campus in time for classes.

Class time is divided evenly among lecture, group discussion, and debate. Both competition and companionship motivate Challenge students to achieve. Informal peer tutoring is encouraged, and the majority of students help one another in at least one content area so that they can keep pace with the accelerated curriculum.

Field trips enrich classroom learning in Challenge '85. Students participate in approximately four trips a year, in which they are exposed to a variety of mathematics- and science-related experiences and career opportunities. For example, Challenge students compete in mathematics and science contests, which are held at Oklahoma State University. Challenge classes also visit the Grand River Dam Authority in Chouteau to see how electricity is made. Finally, students tour area colleges and universities to learn about post-secondary educational opportunities.

In an effort to encourage participation in the program, students are graded on a 5.0 scale (i.e., 5.0 = A, 4.0 = B...1.0 = E) in their

eleventh grade Challenge classes. Moreover, courses taken at Challenge '85 are labeled "accelerated" on the student's academic record. This grading system helps alleviate concerns of prospective Challenge students, who fear that their chance to become class valedictorian--an important scholastic honor in the three school districts--may be jeopardized by the receipt of a lower grade in the Challenge program.

In their senior year, Challenge '85 students can enroll concurrently at the nearby state college, with tuition fees paid by the Challenge program. This financial incentive encourages many students to consider college course work--in a region of the country where only 50 percent of all high school students pursue a post-secondary education. Challenge '85 students can take courses provided by Rogers State College at either Claremore or Pryor. At Claremore, the college's main campus, students can select from a wide range of courses that includes mathematics and science. At Pryor, students can take courses in history, humanities, English, and government. Challenge '85 students are eligible to receive college credit for up to six hours of course work once they enroll officially in the state college system.

Student Selection Process. Most often, students begin Challenge '85 in the fall of their junior year. Eleventh or twelfth grade high school students attending the Salina, Chouteau, or Locust Grove public schools must meet the following criteria in order to participate in the program: 1) score in the 90th percentile or above on the nationally-normed achievement tests administered by the district (Salina and Chouteau use the Metropolitan Achievement Test; Locust Grove uses the California Achievement Test); 2) agree to meet study guidelines prescribed by the Challenge '85 Governing Board; and 3) be approved by the Challenge '85 Governing Board. In addition, principals and teachers may nominate students who have a high cumulative grade point average, especially in the areas of mathematics and science. Guidance counselors contact and recruit students based upon their academic records. Counselors provide information on Challenge '85 and assist students with scheduling and grading while they are in the program. Discipline,

tardiness, or academic problems that occur at Challenge also are referred to the guidance counselors.

Because the Challenge '85 facility can accommodate only 24 students, each of the three districts must select eight students according to the above criteria. If, in a given year, one district does not meet its student quota, the remaining slots are reapportioned to the other districts. In 1987-88, 26 students participated in Challenge '85, 37 percent of whom were economically disadvantaged.

Program Staffing. Challenge '85 students receive instruction from one teacher, who is certified to teach both high school mathematics and science. She is assisted by an instructional aide and a non-instructional aide. The instructional aide provides individual tutoring to students during class time. The non-instructional aide performs clerical duties and assists with equipment and supplies.

Program Funding and Administration

Funding. The state grant for small school cooperatives has been the program's primary funding source since its inception in 1985. Under the grant, funds are awarded by the State Department of Education's Office of Rural Education and Technology to small school cooperatives on the following bases: 1) the cooperatives must address the content areas of mathematics, science, foreign language, computer education, and/or music; 2) no award may be greater than \$50,000 and funds may not be spent on capital outlays; and 3) the fiscal agent applying for the grant must be a district with less than 800 average daily attendance, although other districts of any size may be included in the cooperative. Salina is the grantee and fiscal agent, since it is the only district in the cooperative with an enrollment of under 800. The state grants are awarded annually, and are obtained each year by re-application. In 1985, Challenge '85 received \$50,000 from the state; in 1986, \$45,000; and in 1987, \$40,000.

Other state funds include a \$35,000 instructional computer grant, awarded in 1985, which enabled Challenge '85 to purchase its own computer equipment. Although local high schools also have computers,

there is an insufficient number to serve all students adequately. At Challenge '85, each student enrolled in the computer science elective spends 40 minutes a day on the computer, often with the assistance of a teacher or an instructional aide.

Administrative Structure. Challenge '85 is administered by a governing board, composed of representatives of the school boards of the three districts. The board meets two or three times a year to discuss and resolve issues. Day-to-day administration of the program is the responsibility of the Salina school district superintendent, whose office is located closest to the Challenge '85 facility.

The program's teacher is employed by the Salina school district, as Salina is the official recipient of the State grant that pays her salary. However, superintendents of all three districts interviewed and approved her prior to her appointment at Challenge '85.

Impact of Challenge '85

As shown in Table 2, a greater percentage of Challenge '85 graduates have pursued further education over time than graduates of the regular high schools within the three member districts. Further, in 1987-88--after three years of program operation--the percentage of Challenge '85 students pursuing further education or training exceeded that of regular high school students in all three districts.

Table 2

COMPARISON OF CHALLENGE '85 AND OTHER HIGH SCHOOL STUDENTS'
PARTICIPATION IN HIGHER EDUCATION OR TRAINING
1985-1988

School District	Percentage of Graduates Pursuing Higher Education or Training					
	1985-86		1986-87		1987-88	
	Challenge '85	Other High School	Challenge '85	Other High School	Challenge '85	Other High School
Salina	38	43	43	45	60	42
Chouteau	57	52	86	69	57	48
Locust Grove	73	61	60	60	67	58

Program Transferability

Challenge '85 has developed as a collaborative model for meeting the academic needs of highly able students from rural school districts. As a model, the program has the potential for being implemented in other school districts with similar needs. The following three factors are important to consider in the transfer process: 1) a workable model of collaboration, 2) availability of instructors certified in more than one content area, and 3) availability of a facility that is centrally located. Another less critical factor is the availability of local colleges and universities that can provide opportunities for students to enroll in courses for college credit. Each factor is discussed below.

Collaborative Model. Critical to the success of Challenge '85 has been the willingness of the three school districts to work together in designing, funding, and operating the program. Replication of the model requires equal participation by member school districts, as well as the designation of responsibilities across districts for program operation.

Instructional Staff. Qualified instructors are an integral part of the program. Since rural districts are likely to have small numbers of highly able students and limited resources, the hiring of additional instructors to teach in the program would be minimal. However, program instructors need to be certified in more than one content area and qualified to teach highly able students, so that a variety of accelerated courses can be offered in the curriculum.

Centrally-Located Facility. Another factor that is important in replicating Challenge '85 is the availability of a centrally-located separate facility. Such a facility needs to be accessible to all participating school districts, so that students can be transported between the program site and their home schools with minimal time loss. Furthermore, the choice of a neutral site for the program eliminates the need for students to attend classes in a rival school, which is often an issue among competing school districts in rural communities.

Higher Education Institutions. A final consideration is the availability of local colleges and universities that can provide opportunities for twelfth grade students to enroll in classes for college credit. Since the second year of Challenge '85 involves concurrent enrollment of students in high school and in college, the adoption of the complete Challenge '85 model would require the participation of institutions of higher education.

IV. JAMES A. GARFIELD HIGH SCHOOL'S
GIFTED AND TALENTED EDUCATION PROGRAM
(Los Angeles, California)

Introduction

During the past decade, James A. Garfield High School's Gifted and Talented Education (GATE) Program has provided students with opportunities to excel academically and develop positive self concepts. The GATE program features an extensive array of Advanced Placement and honors courses and enrichment activities for underachieving, highly able students. A special feature of the program has been its courses in mathematics and the humanities. A comprehensive counseling and support network helps students master the accelerated curriculum and provides special assistance to those who are economically disadvantaged.

As part of the Los Angeles, California Unified School District (LAUSD), Garfield is one of 49 high schools. Garfield serves approximately 3,500 students in grades 10-12, 97 percent of whom are Hispanic. In 1988, 280 of these students were enrolled in the GATE Program. Sixty-eight percent of Garfield's student body participates in the federal free or reduced lunch program--a participation rate that exceeds the district's by 20 percentage points.

Development of a District Strategy

In an attempt to foster the achievement of high school students, the LAUSD GATE program has encouraged the development of AP programs at all high schools in the district. AP was selected as the vehicle for promoting academic accomplishment, because it represents an external goal that students can work toward.

Concurrent with this district strategy, Garfield High School underwent an internal transition in the early 1980s. During the 1970s, the school was experiencing high dropout rates, theft, drugs and alcohol problems. Moreover, student test scores were declining at an increasing rate. In order to improve student attitudes and classroom behavior, Garfield's principal instituted a strict discipline program,

and worked with parents and community service providers to build a more challenging educational environment. The principal also initiated a curriculum reform effort to boost the school's low academic standing in the district. Part of this reform involved the creation of AP Calculus in 1979 by Jaime Escalante, which was the impetus for a comprehensive accelerated academic program. Over time, additional AP courses were added to the curriculum, honors classes expanded, and a separate track for under-achieving gifted students was instituted. The development and implementation of Garfield's GATE Program was based upon the assumption that all students can achieve if they are given systematic instruction, a nurturing environment, and continuous feedback.

Student Identification Process

Ninety-five percent of Garfield's students are identified as gifted in elementary and middle school. Following the state's guidelines, the district uses multiple criteria in the identification process that include aptitude testing and teacher recommendations. Assessment data are reviewed and students determined to have abilities in one or more of the following categories are accepted for admission into the GATE Program: intellectual ability; high achievement; specific academic ability; performing arts ability; and visual arts ability (Student Guidance Services Division, 1985).

Garfield's faculty have worked with administrators at its three feeder middle schools to ease highly able students' transition from middle to high school. Faculty have shared information about Garfield's program, particularly the requirements in mathematics, and have apprised incoming sophomores about the variety of options available to highly able students. As a result of this effort, increased numbers of sophomores have entered Garfield as GATE students.

In addition to those formally identified as highly able in middle school, all Garfield students are encouraged to enroll in AP and honors classes. Students interested in participating in the AP program write a brief autobiography, are interviewed by a member of the GATE faculty, and must be recommended by a teacher. Similarly, a prospective honors

student must complete an application and be accepted by an honors teacher in a particular content area.

GATE Program Components

Once enrolled at Garfield, a highly able student may participate in a broad array of advanced-level courses. In addition, a variety of support services are available for students, including enrichment activities, financial assistance, and counseling. The curriculum enables students to grow intellectually, while the support system instills confidence in students, so that they can achieve to their full potential. Each of the program components is described below.

Curriculum. Garfield offers three types of accelerated and enriched programming to its able students--AP courses, honors classes, and academic enrichment.

AP classes are college-level courses that cover academic content at an accelerated pace and in greater depth than is normally taught in a class. The AP classes prepare students to compete in AP examinations, and possibly earn college credit for their satisfactory performance on an examination. Garfield offers a number of AP courses in mathematics, science, and the humanities to juniors and seniors. The following mathematics and science AP courses, with the relative numbers of sections offered, are taught at Garfield: Calculus AB (five), Calculus BC (one), Biology (one), Chemistry (one), and Physics (two).

AP Calculus students are required to attend enrichment classes at East Los Angeles College on Wednesday evenings, Saturday mornings, and during the summer. Recently, other AP classes--e.g., English--have followed this example of providing enrichment beyond the regular school day to supplement acceleration in the classroom.

Included in the humanities offerings is a "back-to-back" AP American History and Honors American Literature program for 11th grade students. This block course prepares students for college-level writing, which often is difficult for the Garfield students for whom English is a second language.

In order to encourage expansion of the AP program at the school, any new instructor or one who teaches two or more AP courses receives an extra class period for preparation. Normally, all Garfield teachers receive one planning period per day--a practice that exceeds the district's requirement. Students are provided with a number of incentives to facilitate their participation in the AP program. The AP testing fee is paid, in part, by Garfield through state funding and private donations. Students also are transported to the testing site, if the test is not administered on the Garfield campus. Finally, students enrolled in the AP courses are given special AP jackets and T-shirts--funded by private donations--to motivate their performance.

Several of Garfield's AP instructors utilize special teaching techniques to foster academic achievement. For example, Jaime Escalante uses a unique teaching approach that encompasses intensive student interaction, hands-on activities, and humor. Above all, the approach requires that the teacher get involved extensively with his/her students. In addition to contacting the family of the new AP student before the school year begins, Escalante signs a contract with the student and his/her parent or guardian. The contract, which specifies the responsibilities of each party throughout the year, is monitored carefully by the instructor. In the classroom, Escalante uses a variety of props and visual aids to capture students' interest and illustrate mathematical concepts (e.g., a baseball and mitt are used to illustrate the concept of limits in calculus). Short "catch words" are used to describe major mathematical principles and operations, since such terms are easily understood by students. The teacher involves his students extensively in classroom problem-solving exercises, and often injects humor into the discussion, so that students enjoy the learning process. Finally, posters of star athletes decorate the classroom walls and serve as role models for the students; the phrase "Ganas"--a motto coined by Escalante that means a desire to learn, to get ahead, to improve oneself--surrounds the posters.

Supplementing the AP courses are honors classes, in which the academic content is addressed in greater depth and at a faster pace than

in the regular classroom. While the honors classes prepare tenth grade students for the AP program, they also are offered as advanced courses for subject areas not included in AP. Garfield offers honors courses in a variety of subject areas, including mathematics, biology, and computer science.

In order to encourage more high school students to take honors courses, the University of California instituted a policy in 1982 whereby students could earn an extra grade point for every honors-level course completed. At Garfield--where students feared that a poor final grade in an honors course would hurt their overall grade point average (GPA)--this policy has encouraged many to enroll in honors courses.

Academically Enriched (AE) classes are offered to Garfield's sophomores and juniors who were identified as highly able in middle school, but who are no longer achieving at a level considered satisfactory for GATE students by the time they reach high school. In tenth grade, these highly able, underachieving students enroll in a Pre-Scholastic Aptitude Test (PSAT) preparation course to learn verbal and mathematical skills. Students who still are identified as underachieving gifted in the eleventh grade enroll in the back-to-back American Literature and Composition/U.S. History course. To help motivate underachieving students, Garfield's instructors organize enrichment activities, such as student-performed plays and intra-school academic competitions. By grade 12, underachieving students are expected to qualify for the school's honors or AP classes (James A. Garfield High School, 1987).

Support Services. In order to provide highly able, economically disadvantaged students with the guidance and individual attention needed to master the accelerated and enriched curriculum, a variety of support services are available. Counselors, teachers, and school administrators work to provide a nurturing environment at Garfield. Students receive assistance in designing their academic program, planning for college and/or careers, or resolving family problems. In addition, financial assistance is available to those taking AP examinations.

Every student in the regular, as well as GATE Program at Garfield, has a counselor. The GATE counselor assists in identifying and tracking the underachieving gifted. As one of ten counselors at Garfield, the GATE counselor serves approximately 280 GATE students plus about 100 other regular students. He is available to students at any time during the day and immediately after school.

Teacher involvement in students' lives extends beyond the regular class period. Garfield's faculty are committed to the GATE Program and to the school's students. Teachers provide additional academic support to students during evening and weekend class sessions. For example, some teachers take students to cultural events or invite them to their homes for dinner, so that students are exposed to a variety of community experiences. Whenever possible, teachers attempt to provide role models to their students through visits to performances or lectures given by prominent minority community members, and meetings with Garfield graduates who are successful in college. When the need arises, teachers become involved in their students' personal lives and help to resolve family problems. In addition, teachers--as well as counselors--will visit the homes of Garfield students when necessary to talk with parents about the importance of a college education for their children.

Supplementing the services provided by counselors and teachers is student financial support. In addition to funding a portion of the AP examination fees through private contributions, Jaime Escalante has worked with a private foundation, which supports students' attendance in summer school. The stipends offset the wages students otherwise would earn from a summer job. In order to receive the stipends, students must attend classes regularly and set aside a portion of the funds for college.

Program Staffing

The number of staff at Garfield serving highly able students has grown substantially over the past ten years. In addition to a part-

time coordinator for the GATE Program and a full-time counselor, Garfield has ten faculty members who teach AP and honors courses.

The gifted coordinator organizes staff development activities and instructs classes. The counselor helps students select appropriate courses. Honors and AP teachers--who have either a full California credential or a provisional California credential--participate in various staff development activities, sponsored by both the school and the district.

At Garfield, new AP teachers obtain assistance from experienced faculty. Often, new teachers receive release time to observe others instruct their students. The district's gifted coordinator works closely with the district's curriculum supervisors to provide training and technical assistance to GATE faculty at Garfield. Los Angeles Unified School District sponsors about 75 in-service sessions per year. Through a program called Advancing Science with Advanced Placement (ASAP), the district offers two weeks of training in strategies for teaching AP science courses. ASAP was initiated to increase the number of AP courses offered in the district's high schools. The district also has developed teaching kits that cover each of the six laboratory exercises now tested on the AP science examinations. In addition to financing the ASAP sessions, the district provides funds for GATE teachers to attend other AP workshops sponsored by the College Board.

Funding and Administration

Funding. Garfield receives support primarily from the district and the state to operate its GATE Program. In 1986-87, approximately \$10,500 in state gifted monies (allocated to the LAUSD) supported Garfield's gifted program (Budget Services and Financial Planning Division, 1987). At a rate of \$65 per student per year, the district funds instructional materials, field trips, and teaching substitutes. Also, one class period per day of the gifted coordinator's time is supported by the district. The district and state support the counselor for gifted students and some staff development activities.

A non-profit, private organization called the Foundation for the Advancement of Science Education (FASE) funds the Saturday and summer AP sessions held at East Los Angeles College. FASE is supported by foundation and corporate donations.

Administration. Garfield's GATE Program is one of 618 district-sponsored programs operating in Los Angeles. While the school's principal and gifted coordinator are responsible for the day-to-day administration of the program, the district's gifted and talented coordinator provides assistance with student selection procedures, programming, and staff development. An assistance review team also monitors Garfield's GATE Program for the district.

Program Impact

Garfield High School's GATE Program has been effective in increasing student enrollments in science and mathematics classes, improving student performance on the AP examinations, and in improving student performance in academic competitions. Each of these outcomes is discussed below, along with the relevant supporting data.

Increased Student Enrollments in Science and Mathematics. As shown in Table 3, the number of mathematics and science classes offered at Garfield has increased considerably from 1981 to 1988. Moreover, the number of students enrolled in both subject areas increased seven-fold over the seven-year period.

Improved Student Performance on AP Examinations. In 1980, 45 AP examinations were taken by Garfield students. In 1987, 327 examinations were taken, with the percentage of those students scoring 3, 4, or 5 (the passing rate) above the national average. Specifically, the number of examinations scoring in the 3-5 point range rose from 25 (or 56 percent of all examinations taken) in 1980 to 240 (or 73 percent of all examinations taken) in 1987.

In 1986, 93 Garfield students took the AP Calculus examination--the seventh highest total number of students among U.S. public high schools. Further, 84 percent scored a 3 or above.

Table 3
COMPARISON OF STUDENT ENROLLMENTS IN
MATHEMATICS AND SCIENCE CLASSES

Subject	<u>Number of Classes</u>		
	1981	1986	1988
<u>Mathematics</u>			
Algebra I	9	30	27
Algebra II	1	11	18
Geometry	6	16	28
Calculus AB	1	4	5
Calculus BC	0	0	1
Trigonometry	0	4	4
Math Analysis	0	4	4
Total Classes	17	69	87
Total Students	(300)*	(3,000)**	(3,200)***
<u>Science</u>			
Chemistry	2	17	21
Physics	1	4	6
AP Chemistry	0	0	1
Biology	0	0	28
Physiology	0	0	4
Advanced Physical Science	0	0	4
Total Classes	3	21	64

*Total student body = 3,300

**Total student body = 3,400

***Total student body = 3,500

Source: Performance Report for California Schools, James A. Garfield High School, 1986-87.

Improved Student Performance in Academic Competitions. Over the past few years, Garfield's students have participated in the Academic Decathlon, an academic competition held annually across the State. In 1982, Garfield's team placed 48th--out of a total of 53 participating teams--in the city. In contrast, for each of the past three years (1985-87), Garfield's teams have placed in the top ten. In 1986, Garfield ranked third citywide--out of 54 teams--in the Academic Decathlon.

Program Transferability

The GATE Program at James A. Garfield High School has developed as an acceleration/enrichment model that meets the academic and socio-emotional needs of highly able, economically disadvantaged students. As a model, the program has potential for being implemented in other districts and schools that wish to serve minority and/or disadvantaged students. In order to implement this model, the following conditions must be met.

First, a school should have a special coordinator to administer the program. Second, at least one-full time counselor is needed to assist highly able students in program planning, monitor student performance, and help with career and college preparation. Third, a faculty experienced in teaching highly able, disadvantaged students and familiar with advanced-level work in the various content areas is desirable. Fourth, it is advantageous if the school staff--including administrators, teachers, and counselors--share the philosophy that all students should be given opportunities to achieve to their maximum potential by participating in enrichment and accelerated courses. Finally, it is necessary to have a stable funding source to support staff, materials, and equipment required for the gifted program.

V. RICHMOND COMMUNITY HIGH SCHOOLIntroduction

Richmond Community High School (RCHS), an alternative high school in the Richmond, Virginia Public Schools, provides an accelerated and enriched program for economically disadvantaged, gifted students. RCHS is one of three alternative high schools in the district, along with six comprehensive high schools. Of the 26,000 students attending Richmond Public Schools, the majority (23,000) are black and 64 percent are enrolled in the federal free or reduced lunch program. In 1987-88, RCHS served 182 students in grades 9 through 12, 44 percent of whom were male, and 56 percent of whom were females. Sixty-nine percent of the students were black; 26 percent were white; and five percent were Asian. Fifty-six percent of RCHS students participate in the federal school lunch program.

Creation of a District Strategy

Richmond Public Schools (RPS) first established alternative high schools in the early 1970s, in order to: 1) attract more students to the city's public schools as families moved to the suburbs; and 2) provide students with opportunities to achieve academically in an enriched learning environment. At this time, the district's administration found that the comprehensive high schools were not meeting the needs of a portion of the district's highly able students, some of whom were economically disadvantaged, minority students. Thus, the district created a mechanism for serving these students, which could address their specialized academic and social-emotional needs.

The first alternative school served elementary students. Alternative middle and secondary schools were established shortly thereafter to provide a continuous individualized academic program. RCHS was founded as the district's second alternative high school in 1977, through the efforts of Andrew J. Asch, Jr., a prominent Richmond businessman. As a parent of children who had been given opportunities to develop their potential, Asch wanted to extend such opportunities to

less advantaged students whose academic needs were not being met by existing secondary programs.

In 1975-76, Asch worked with a committee composed of educational and community representatives to develop a four-year demonstration program that he would fund. The committee issued a request for proposals, and Margaret Dabney of Virginia State University (VSU) joined with the Office of the Superintendent of Schools to propose a project based on John Dewey's philosophy that all learning is a reconstruction of experience. Dabney's vision was to create an alternative secondary school, which would provide highly able, economically disadvantaged students with a variety of off-campus, interdisciplinary learning experiences that would enhance their capacities to meet their academic potential. VSU--in conjunction with RPS--was awarded the grant, and in 1977 the school opened in the city's civic auditorium. Subsequently, additional resources were provided for the school's operation by Virginia Commonwealth University (VCU), the University of Richmond (UR), Virginia Union University, and businesses and agencies in the community (Dabney, 1987).

The RCHS Program

Since its inception, RCHS has provided a program aimed at developing students' academic skills, creative talents, and self-esteem. Specifically, RCHS has undertaken activities designed to: 1) develop students' basic and higher order thinking skills and increase their knowledge of specific content areas; 2) enable students to evaluate and apply knowledge to academic, personal, social, and career decisions, with an emphasis on opportunities for post-secondary education; 3) develop students' self-worth and self-esteem; and 4) clarify students' personal and social values for building and living in a pluralistic society as responsible citizens and as group members.

To address these objectives, RCHS has implemented a comprehensive program characterized by the following key features: 1) a multiple criteria selection process; 2) an accelerated and enriched curriculum; and 3) support services that foster a family or community spirit. In

addition, the community has been and continues to be involved in establishing and implementing program policy. Each of these features is described below.

Student Identification and Selection. Economically disadvantaged, gifted or potentially gifted high school students who reside in the City of Richmond are eligible for admission into RCHS. According to RCHS, academically gifted children are those students identified by professionally qualified persons, through a variety of assessment strategies, as having superior intellectual, creative potential and functional abilities for academic performance.

Based on this definition, RCHS uses a comprehensive identification and selection process for determining admission into the school. Three categories of criteria are considered in the identification process: 1) students' performance on aptitude and achievement tests; 2) students' demonstration of creative abilities; and 3) students' demonstration of leadership, motivation, and adaptability. Prospective students are identified through referrals obtained from administrators, teachers, and counselors in Richmond's public, private, and parochial schools. In addition to these referral sources, RCHS students and parents of students nominate potential applicants.

In order to be considered for admission into RCHS, students must participate in a comprehensive selection process, which includes: 1) submission of an essay and an original product, and participation in an interview; 2) completion of a questionnaire by the student's parent or guardian, which indicates his/her interest in the program; 3) submission of a teacher's recommendation; and 4) completion of various aptitude and achievement tests. RCHS compiles a developmental profile of each prospective student, which consists of the following: 1) aptitude scores--Short Test of Educational Ability (STEA) and Otis-Lennon; 2) achievement scores--Science Research Associates (SRA), primarily reading and mathematics or science; 3) products--essays, projects, art work; 4) creativity measures--Torrance Test of Creativity, writing sample, and interview; 5) motivation and leadership measures--Renzulli-Hartman Scale, and an interview; and 6) parent questionnaire.

Selection of RCHS students is made by a Selection Committee, consisting of RCHS's principal, program coordinator, counselor, and four Advisory Board members who are education and community members. The Committee uses the following scoring criteria in the selection process:

- Intellectual Functioning--one or more of the following:
 - Aptitude scores within upper 10% of RPS;
 - SRA reading above 90th percentile; and
 - SRA science or math above 90th percentile and/or submission of a product that is judged by an expert in the field to be excellent.
- Creativity
 - Score of 3 or above on the Torrance Test of Creativity Scale.
- Psycho-Social Factors
 - Score of 3 or above on the RAP Scale; and
 - Score of 3 or above on the Renzulli-Hartman Scale.

The Selection Committee conducts a first review of the developmental profiles, computes composite scores for each applicant based upon the various criteria, and enters these scores on a matrix. In addition, the Committee considers the demographic characteristics of students, and attempts to select a student body that is primarily economically disadvantaged, has a balanced sex ratio, and has a racial distribution that reflects that of RPS. The Selection Committee uses the following criteria to determine a student's socioeconomic status: a) eligibility for the federal free or reduced lunch program; b) family income that falls within the federal poverty guidelines; and c) presence of a family member who receives public assistance, or residence with relatives or guardians other than parents.

The Selection Committee categorizes applicants according to three types of eligibility--clearly eligible, questionably eligible, and clearly not eligible--and then conducts a final review of the updated developmental matrix of each student. Final selections are made and an alternate list for each racial/ethnic, sex, and income category is established. Selection notifications and a parent contract--outlining the full scope of the program and the family responsibilities that it entails--are sent to parents or guardians, who are asked to return one copy of the signed contract. Parent endorsement is required for a student's admission into RCHS. Each entering student is guaranteed one year of enrollment, after which a summative evaluation conference is held to determine the student's future status in the program.

Accelerated and Enriched Curriculum. RCHS students participate in a unique academic program that encompasses both on- and off-campus learning experiences, which are designed to address the needs of economically disadvantaged students. RCHS's program components and activities provide a continuous interaction of intellectual, emotional, and physical learning, which reflects RCHS's conception of giftedness, and its emphasis on the intellectual, creative, and psycho-social characteristics of students (Dabney, 1982). The program includes: required and elective courses and activities; an Alternative Wednesday Schedule (AWS); and an Adopt-A-School program.

To graduate from RCHS, students must earn the following credits, which exceed the State's high school graduation requirements in mathematics and science: four credits in mathematics (must include computer science); four credits in science (three in laboratory courses); three credits in one foreign language or four credits in two; four credits in social studies; four credits in communicative arts; two credits in health and physical education; and two credits in electives (at least one in the performing arts).

RCHS also requires that its students complete a junior-senior independent research project prior to graduation. Students choose their own topic and conduct the research after school hours under the supervision of RCHS staff, a local university professor, or a community

member. Students are required to make an oral presentation of the project to fellow classmates and school staff at the end of the year. Illustrative projects have included a volunteer internship at the Science Museum and a lab assistantship for a chemistry professor at VCU.

Communication skills, career education, future studies, and human relations/personal growth are integrated into all curriculum courses. Interdisciplinary studies (combining history, English, and the humanities) are required in all four years. All courses are accelerated, such that content is covered in more depth and at a faster pace than would occur in a regular high school class. RCHS uses a "modified block schedule," whereby double lab periods are offered two days a week.

In addition to coursework, RCHS students are required to participate in a nine-day ecology field trip to the Chesapeake Bay during their freshman year. In this cross-disciplinary initiative--involving mathematics, science, English, and social studies faculty--students learn about the physical environment and its history. They also are taught how to be more independent and how to relate to their peers.

All freshmen and sophomores are required to enroll in a summer program, which extends their school year to 11 months. This program is designed to provide students with experiences that will build their capacities to undertake accelerated academic work. The freshman year program is science-related, and has covered topics such as archaeology and computer science. During the sophomore year, students study topics in the humanities (e.g., dance, art history).

Finally, students must participate in community meetings--e.g., the Alternative Wednesday Schedule. Instead of attending regular classes on Wednesday, each student engages in a variety of on-campus learning activities. Usually, two hours of the day is spent exploring a cross-disciplinary topic area or class-specific issues (e.g., freshmen: organization and study skills). Another hour is spent in "People Classes," where students or teachers instruct other students in a hobby or special interest. On alternative Wednesdays, students participate in community meetings--run by the student government body--where issues

of concern are discussed, and in community conversations--where community speakers come to the school for presentations on current topics. Class or club meetings also may be held on Wednesdays.

Supplementing this required on-campus program is a combination of optional off-campus learning experiences, ranging from enrollment in college courses (including an Adopt-A-School Program) to mentorships. Local colleges and universities, such as Virginia Commonwealth University, University of Richmond, and J. Sargeant Reynolds Community College, permit RCHS students to earn college credit for courses they take at these institutions. Calculus is among the various courses offered to RCHS students. Also, RCHS has entered into an Adopt-A-School relationship with VCU. VCU "adopts" RCHS in order to assist students' transition from high school to college and to enhance students' understanding of American business and the economy. VCU's School of Business and Cooperative Education Program sponsors a business essay contest for all RCHS students; offers a summer work experience to juniors and seniors; and sends a VCU counselor to RCHS twice a week to speak with students.

In addition to college programs, RCHS students are encouraged to undertake mentorships in the community. Students may earn up to one-half an elective credit for the experience, but cannot be paid. A program director at RCHS carefully matches the student with a mentor, who may be a local college professor, museum staff, or a corporate employee. Mentorships may be short- or long-term, and can be initiated by either the student or RCHS staff.

Supplementing these optional off-campus activities are scheduled field trips for classes that are integrated closely with the curriculum, and special contests or competitions, usually sponsored in conjunction with other area schools. For example, RCHS students regularly attend the Virginia Junior Science and Humanities Symposium. In 1988, RCHS students participated in three days of presentations, demonstrations, and tours. Twelve student papers were selected to be read.

Support Services

RCHS students are provided with comprehensive support services to enable them to master this accelerated and enriched curriculum. RCHS has one full-time counselor for its 182 students, who provides a range of services to meet students' academic and social-emotional needs. These services are: group and individual counseling; sponsorship of career awareness programs; provision of college preparation and application assistance; guidance to parents on an as-needed basis. The counselor meets with freshmen and sophomores monthly and with juniors and seniors at least weekly. She serves fewer students than counselors at the district's comprehensive high schools, and helps students at all four grade levels, not just one. Also, RCHS students have access to the services of a district psychologist, who visits the campus about one day a week.

Each RCHS student belongs to a "family," a group of 12-15 students who are from all four grade levels. Each family is lead by a teacher (all RCHS teachers are "family heads"), who serves as the chief advocate for the student. Each day families meet for 30 minutes to discuss academic and personal matters and school events. This family experience fills an important void for RCHS students who lack strong support at home.

Parent Involvement

Parental support and involvement in RCHS affairs varies. However, all parents are required to participate in a core of activities. Parents of RCHS students must sign a contract when their child first enrolls in the school. This contract outlines family responsibilities and suggests areas where parents can provide additional support. Also, all parents must participate in a conference with RCHS staff at the beginning of the year to set goals for their child. In addition, parents are required to pick up their child's first report card at an open house in the fall and parents of freshmen attend an orientation session during the beginning of the school year. In spite of these efforts, RCHS has encountered some typical problems in involving parents in high

school activities, primarily because so many parents work full-time, leaving few hours for school participation. Consequently, a great deal of parent involvement takes the form of telephone contact with RCHS staff regarding students' academic achievement and participation in off-campus activities.

Community Involvement

The involvement of Richmond community members is critical to the management and operation of the school. An Advisory Board, composed of parents, educational professionals, and community organizations, sets program goals and objectives; develops policy guidelines; selects sites/facilities, students, and staff; provides the school's supplementary budget and monitors expenditures; and arranges for program evaluations. The school's founder, Andrew Asch, serves on the board, which has been in existence since the school's inception in 1977. The board meets at least five times a year, in addition to an annual meeting in June. Standing members of the board include one representative each from Virginia State University and Virginia Commonwealth University, two parents, and two students. The remaining board members are not specified although an attempt is made to obtain a mixture of individual backgrounds and professions. Members may serve one-, two-, or three-year terms, and are elected annually.

Staffing

Students attending RCHS are served by a variety of staff, including a program coordinator (specified in the school's original design), teachers, and a counselor. The program coordinator works with the School Board in the development of the curriculum, overall supervision of the program fundraising, and public relations. Sixteen full-time and seven part-time teachers serve as faculty, who have instructional responsibilities as well as serve as family heads and organize the Alternative Wednesday Schedule program. The counselor provides assistance to students in scheduling, career and college preparation, and

with social-emotional problems. Also, the counselor coordinates special programs, including academic competitions and college visits.

RCHS faculty are certified according to district requirements and attend district-sponsored staff development sessions twice a year. Also, RCHS teachers are encouraged to participate in training sessions concerning the teaching of gifted students. New RCHS faculty are oriented by current staff and receive a program manual. Periodically, RCHS faculty receive school-sponsored training.

Funding

Currently, RCHS receives its funds from two primary sources--the district and private contributions. In 1987-88, district funds of approximately \$730,000 and private contributions of \$75,000 from corporations, individuals, and foundations supported RCHS. In prior years, district support was slightly less, while private contributions were considerably more, due to increased community awareness activities.

Administration and District Coordination

Program Administration. The principal of RCHS is the instructional leader and administrator, and has the primary responsibility for implementation, supervision, and evaluation of the program. The Program Coordinator collaborates with the principal in program implementation and evaluation, serves as program liaison with all collaborating agencies, and manages the research and development aspects of the program. The school counselor assists with the collection of research data and develops and implements the special guidance and counseling approaches that are needed for disadvantaged able learners. These activities often include staff development. The school's Advisory Board commissions an external evaluation of RCHS every two years.

In order to monitor the progress and success of RCHS students, a variety of state, district, and optional data are collected by staff annually. These data are: college acceptances and scholarship earnings; college credit hours earned by juniors and seniors; attendance; enrollment; Test of Achievement and Proficiency (TAP) scores of

juniors; and the Torrance Test of Creativity scores of all students. Also, twice a year, RCHS staff collect Scholastic Aptitude Test (SAT) scores of students, and, periodically, RCHS graduates are surveyed to obtain other follow-up data.

At the district level, the Assistant Superintendent for Secondary Education, with the assistance of the Director of High School Education, monitors the RCHS program. Periodic meetings are held with RCHS staff and various information on the school is kept on file in the district office (e.g., curriculum guides and materials; descriptive statement of program; school profile including data on attendance, academic performance, parent involvement, and extra-curricular activities). The district permits RCHS, as it does other alternative schools, to operate with reasonable independence and flexibility.

Articulation. Gifted programming for students attending RPS is limited but growing. At the elementary level, a pull-out program provides special instruction for gifted students one-half day a week. At the middle school level, there is a separate elective course each semester for highly able students. At the secondary level, alternative schools (such as RCHS) offer a special curriculum or highly able students may enroll in accelerated, honors, or Advanced Placement classes at their home schools.

During 1987-88, the district began a new program in which fourth and fifth grade students who have exceptional abilities in mathematics are released one day a week for in-depth instruction by a leading mathematics teacher. As part of the program, students are placed in appropriate mathematics classes after fifth grade.

Program Impact

A major goal of RCHS is to provide students with the intellectual training and support to pursue higher education. RCHS has been successful in meeting this goal, in that over the past three years 99 percent of RCHS graduates have enrolled in colleges and universities. Further, 100 percent of RCHS students have been accepted by colleges and universities. Colleges currently attended include: the College of

William and Mary, Duke University, Georgetown University, Hampton University, Howard University, Mt. Holyoke College, North Carolina State University, Oberlin University, Princeton University, the University of Virginia, Virginia Commonwealth University, Virginia Military Institute, Virginia Polytechnic Institute, and Virginia State University (Richmond Community High School, 1988). This college attendance rate compares to a rate of 51 percent for students attending other Richmond area high schools. Moreover, approximately 25 percent of RCHS's graduates enter mathematics- or science-fields in college.

Program Transferability

As an alternative high school, RCHS has a number of program components that can be implemented independently or as part of an overall program strategy for serving highly able, disadvantaged students. In districts where there is an existing structure for operating specialized, magnet, or alternative high schools, the RCHS model can be replicated as a comprehensive program that includes: a multi-dimensional selection process; an accelerated curriculum; off- and on-campus enrichment activities involving community, cultural, and postsecondary institutions; and a counseling and support system. Replication of the complete RCHS model requires the community's support and willingness to collaborate on program activities; financial resources for an enrichment program; and the availability of qualified faculty and staff to offer an accelerated curriculum that includes advanced courses in subject areas such as mathematics and science. Furthermore, a district's willingness to permit flexibility in program operations is a key factor for a successful program.

While the implementation of the complete program is optimal if students' successes are to be maximized, the replication of individual program components can strengthen an existing high school program. For example, the provision of an accelerated curriculum with related enrichment activities is a strategy that can be used effectively with students whose life experiences have been limited. The replication of any of the individual program components requires support, expertise, and resources similar to those needed for implementation of the total model.

VI. DETROIT AREA PRE-COLLEGE ENGINEERING PROGRAM

Introduction

The Detroit Area Pre-College Engineering Program, Inc. (DAPCEP), a multi-component enrichment program for students in grades 7-12, serves the Detroit, Michigan Public School and surrounding school districts. DAPCEP's aim is to increase the numbers of minority students pursuing post-secondary study in the fields of science or engineering. As a non-profit organization located in Detroit, DAPCEP is governed by a Board of Directors who represent the Detroit Board of Education, local universities, corporations, foundations, and parents of program participants. The Board of Directors and DAPCEP staff work together to provide a range of programs, including a middle-school, pre-engineering curriculum, Saturday and summer enrichment and accelerated classes, and career awareness activities, to approximately 1700 students in 34 Detroit area schools. In offering these programs, DAPCEP is attempting to enhance the academic and personal development of Detroit Public School (DPS) students, 85 percent of whom are minority and 52 percent of whom participate in the federal free and reduced lunch program.

Development of DAPCEP

DAPCEP began in 1976 as a summer enrichment program for 245 middle and high school minority students. During 1974-1975, the University of Michigan and Michigan State University faculties had become concerned about the lack of minority student enrollments in science and engineering courses. Not only did these universities want to increase enrollments in these courses, but there also was an interest in improving opportunities for highly able middle and high school students to learn about the science and engineering professions.

In 1976, the University of Michigan and Michigan State University received funding from the Alfred P. Sloan Foundation to develop enrichment activities for motivating middle and high school minority students' interest in science and engineering. These institutions formed a collaboration with the Detroit Public Schools called the Detroit Area

Pre-college Engineering Program, Inc. (DAPCEP). Under the leadership of Mr. Kenneth Hill, the collaborative sponsored seminars and field trips in which minority students from the Detroit Public Schools and surrounding counties could learn about careers in science and engineering. These activities signified the beginning of the DAPCEP program.

After the first year, the program's organizational base shifted from the University of Michigan to Wayne State University. In subsequent years, the program expanded in terms of participating institutions, numbers of students, funding sources, and types of program activities. In 1978, the number of universities increased to four, 400 students were served, the first corporate funding was received, and Saturday and summer classes in science and engineering were offered for high school students. The organizational base for the program also shifted from the University of Michigan to Wayne State University. During 1978-1983, DAPCEP continued to grow and broaden its funding sources, receiving additional support from industry, the Detroit Public Schools, and the six universities.

As DAPCEP's collaborating institutions and activities expanded, Kenneth Hill and the program's staff realized the need to establish an independent entity through which the program could continue raising funds to support its activities. Thus, in 1983, DAPCEP was incorporated as a non-profit organization with a governing Board of Directors. While the Board became responsible for the program's operations, the Detroit Public Schools remained closely associated with the program by supporting Kenneth Hill's salary as executive director.

At the time of DAPCEP's incorporation, the number of universities participating in the program's summer and Saturday classes had risen to six, and student enrollment had reached over 1100 (Hill, 1988). Also increasing were the number of middle schools offering the DAPCEP program, which was a series of activities designed to increase students' knowledge about engineering and encourage their pursuit of the profession. The interest shown by middle schools prompted DAPCEP's executive director and Board to seek funding from the National Science Foundation (NSF) for the development of a structured pre-engineering curriculum.

In 1985, DAPCEP was awarded a three-year NSF grant to develop a middle-school curriculum and career awareness materials.

The creation of the pre-engineering curriculum also included the expansion of DAPCEP staff development activities, which helped to enhance the program during 1985-1987. Increased teacher interest in the program has been reflected in the numbers of DAPCEP middle school students, which almost doubled between 1986-1987. As DAPCEP has grown, the program has been successful in recruiting its target population. Thus, in 1987, 90 percent of the 1700 students served were black, 7 percent were Hispanic, 3 percent were white, and 70 percent were females.

The DAPCEP Program

As a program designed to increase the representation of minority students in the fields of science and engineering, DAPCEP attempts to provide academic and social-emotional support to its participants. While DAPCEP's main focus is on providing academic enrichment classes for highly able students to prepare them for post-secondary training in these fields, the program also offers activities designed to broaden participants' life experiences.

DAPCEP's academic enrichment efforts consist of three components: 1) a middle school pre-engineering program; 2) Saturday enrichment classes for students in grades 9-12; and 3) summer accelerated and enrichment classes for students in grades 9-12. A list of the classes offered in these components is presented in Figure 2. In addition to the various classes, DAPCEP provides support programs for students, including after-school tutoring for all grade levels; a mentor program; and a Summer Bridge employment program for grade 12 students. DAPCEP's academic components and support programs, as well as the processes used to select DAPCEP participants, are described below.

Middle School Program. When DAPCEP began, the middle school program was a variety of loosely-defined academic enrichment activities organized by individual teachers. As middle school interest in the program increased, DAPCEP's pre-engineering teachers recognized the

Figure 2

DAPCEP PRE-COLLEGE ENGINEERING ENRICHMENT COURSES

GRADES 7-8	GRADES 9-10	GRADES 11-12
PRE-ENGINEERING CLASSES	PRE-ENGINEERING CLASSES (9TH GRADE ONLY)	SATURDAY MORNING ENRICHMENT COURSES
Field trips, technical speakers (minority role models included), science fair activities, engineering projects, engineering contests, research on minority scientists and engineers, overview of major engineering disciplines, and films	Same curriculum as grades 7-8 with more advanced content	Fundamentals for General Users- Computer Class- Hewlett-Packard Computer Concepts Unisys Corporation Computer Science and Engineering Design
AFTER SCHOOL TUTORIAL PROGRAM	SATURDAY MORNING ENRICHMENT COURSES	Introduction to Civil Engineering Introduction to Mechanical Engineering Introduction to Electrical Engineering Introduction to Plastics & Polymers Introduction to Computer Science Chemistry Physics Laboratory Experiments Calculus Trigonometry
Students commute to Wayne State for tutorial assistance from former DAPCEP student enrolled in engineering.	Introduction to Computers; Electronic Data Systems; Algebra Introduction to Chemical Engineering	SUMMER PROGRAMS
	Technical Writing Laboratory Science Computer Science Fundamental for General Users-Computer Class- Hewlett Packard	Summer Advanced Pre-College Engineering Program
	SUMMER PROGRAMS	AFTER SCHOOL TUTORIAL PROGRAM
	Introductory Pre-College Engineering Programs (3)	
	AFTER-SCHOOL TUTORIAL PROGRAM	

need to provide students with a more systematic process for developing their research skills and their knowledge of science and engineering, and made these recommendations to the executive director. DAPCEP's grant from the NSF in 1985 provided the program with the resources to create a structured middle school pre-engineering curriculum.

Designed by two science specialists and teachers from the Detroit Public Schools, under the guidance of DAPCEP's executive director and Evaluation Committee, the pre-engineering curriculum is a year-long course taken by students in either grade 7 or 8. Since students in the Detroit Public Schools are taught science in only one of these grades, middle schools participating in DAPCEP offer the pre-engineering course during the year science is not being taught, or as an elective in addition to science.

Middle school participation in DAPCEP is voluntary, and principals make the decision to offer DAPCEP in conjunction with the district's area superintendent--who has administrative responsibility for several schools within an area. Principals generally select students for the DAPCEP pre-engineering course based on four criteria: 1) a student's Grade Point Average; 2) a student's performance on standardized achievement tests given by the district; 3) a student's interest in science; and 4) a teacher's recommendation. The composition of DAPCEP classes varies among schools. In some, the principal selects the top students in either the 7th or 8th grade, and offers a DAPCEP class solely for these students. In other schools, the DAPCEP class is available to students with a broader range of abilities, in an attempt to motivate minority students and develop their skills in science.

DAPCEP's pre-engineering curriculum, which contains four units, is designed to increase students' knowledge about minority scientists and the major engineering fields, and to teach them to apply the scientific method. In the first curriculum unit, "Minority Contributors," students investigate the contributions that minority scientists and engineers have made, and deliver an oral presentation based on their research. The second unit titled, "SWAM DWYPES," presents a strategy for conducting research. Each letter of the acronym stands for a procedure

involved in the research process. Through the application of SWAM DWYPES procedures, students learn the value of research, develop skills to conduct systematic research, and gain an appreciation of science. The third curriculum unit is "Science Fair," in which students learn the sequential and structured method of developing a science fair project. Each middle school student enrolled in the DAPCEP course must participate in Detroit's annual science fair, and this part of the course is devoted to the preparation of a science fair project. The final unit in the curriculum, "Engineering," orients students to civil, electrical, chemical, and mechanical engineering, with an emphasis on the role of engineers in harnessing energy to serve the needs of mankind. Videotapes that illustrate minority engineers at work applying the principles of these four fields of engineering are used to stimulate student interest and discussion (Buri and Ethridge, 1987).

The curriculum, which is packaged in a loose-leaf binder for flexibility, may be used alone or in conjunction with a standard textbook. Supplementing the formal classes are enrichment activities, such as field trips to local museums and industrial settings, and presentations by speakers who work in science and engineering fields.

Saturday Classes. Once DAPCEP students enter high school, they are eligible to participate in a variety of DAPCEP enrichment activities. While most students enter the DAPCEP program during middle school, high school students not previously enrolled in DAPCEP may do so when they reach high school. Saturday classes in science, mathematics, and engineering are offered to students in grades 9-12, whose GPA in science is C+ or higher. DAPCEP students wishing to enroll in a Saturday class must be recommended by the principal or a teacher.

These enrichment classes are held on Saturday mornings throughout the school year at local universities and industrial sites, and are taught by university faculty and professional scientists employed by Detroit's major corporations. Through the classes, students are provided with opportunities to improve their knowledge of algebra, computers, electronic data systems, chemical engineering, and technical writing, and to develop skills in laboratory science.

Summer Program. Another resource for DAPCEP participants is the summer program, which is available to students in grades 9-12. Residential and commuter programs are held on the campuses of four universities that are actively involved in DAPCEP: the University of Detroit; the University of Michigan-Ann Arbor; Michigan State University; and Wayne State University.

The admissions criteria for the summer program are determined by DAPCEP's Board of Directors. Students must submit an application that includes a written recommendation from a teacher or the principal, their high school transcript, and their most recent report card. Preference is given to students who have enrolled in DAPCEP's Saturday classes. University faculty teach the enrichment and accelerated courses, which are designed to enhance students' awareness of science and engineering as career options and provide students with academic preparation for college.

The courses cover an array of topics in science, engineering, and computer science. For example, ninth and tenth grade students enroll in four-week sessions in computer science pre-engineering, communication skills, and mathematics. Eleventh and twelfth grade students participate in six-week, college-level courses in advanced algebra, trigonometry, pre-engineering, and communication skills. A number of the courses cover academic content that is not available to students in their regular high school program, and the content is taught at an accelerated pace.

Support Programs. DAPCEP's academic components are supplemented by three programs that support participants in their learning and personal development. An after-school tutorial program is available to DAPCEP students in grades 7-12. Held at Wayne State University, the program provides free tutoring to students throughout the year in their science, mathematics, and pre-engineering courses. Former DAPCEP students enrolled in engineering courses at Wayne State tutor seventh and eighth grade students, while instructors at the university assist DAPCEP high school students with their courses.

In addition to tutoring services, DAPCEP students and teachers can participate in the Mentor Program. Through the Mentor Program, approximately 35 scientists and engineers from local industries are available to assist students and teachers in the preparation of science fair projects.

Finally, a Summer Bridge program provides students with summer employment in the engineering industry. Graduating DAPCEP seniors are eligible for jobs that give them experience applying the principles learned in their accelerated course work. In 1987, 25 DAPCEP graduates were hired for summer employment from a pool of 70 applicants (Hill, 1988).

Parent Involvement

Parents are an active part of DAPCEP, and have numerous opportunities to assist with program activities. DAPCEP's Board of Directors has three positions that are specified for parents, and Board members recruit parent members regularly. A Parent Advisory Committee assists the program in raising funds and in organizing activities, such as field trips. DAPCEP also sponsors open houses and parent luncheons throughout the year, to foster parents' interest in their children's academic development and to alert parents to the opportunities that are available through DAPCEP. Finally, parent participation in students' work is encouraged, particularly in the preparation of science fair projects--which gives parents an opportunity to work with their children in investigating a scientific problem.

Program Administration and Staff

As a non-profit organization, DAPCEP is governed by an 18-member Board of Directors that includes six corporate and six university representatives, three members from the Detroit Public Schools, and three parent representatives. The Board has six standing committees--Executive, Finance and Development, Program and Evaluation, Audit and Information Systems, and Communications--that are involved in all aspects

of DAPCEP's functioning. The Board meets monthly and is the policy-making body for the organization.

DAPCEP's daily operations are managed by its executive director, with help from an assistant director, an assistant director for development, and four support staff. The Board and executive staff work together closely in setting DAPCEP's priorities, and in overseeing DAPCEP's varied programs.

DAPCEP's academic and support programs are conducted by an array of staff from the Detroit Public Schools, the six participating universities, and volunteers from business and industry. DAPCEP middle school teachers meet monthly to review the pre-engineering curriculum, and discuss classroom instructional strategies and program support activities. The NSF grant for the development of the new curriculum has provided teachers with additional opportunities for staff training in the use of the curriculum.

University faculty from the schools of engineering are responsible for organizing the enrichment and accelerated courses that are taught in DAPCEP's Saturday and summer programs. Finally, professional scientists and engineers from business and industry assist with instruction in these classes, and volunteer their services in the Mentor Program and as featured speakers for DAPCEP.

Funding

Financial support for DAPCEP has increased and become diversified since the program's inception in 1976. During the period 1976-1981, the Sloan Foundation provided \$542,000 for DAPCEP activities. From 1978 through its incorporation in 1983, DAPCEP also received a total of \$288,480 from industry, local universities, and the Detroit Public Schools. Since 1983, DAPCEP has been sponsored by 18 corporate sponsors who contribute about \$200,000 annually. In 1988, for the first time, the City of Detroit granted \$50,000 to DAPCEP. In addition, the Detroit Public Schools supports the salary of DAPCEP's executive director, in-service training for teachers, field trip transportation, and science fair materials. State Gifted and Talented monies are used for

salaries and materials for some Saturday enrichment classes. Finally, DAPCEP's three-year grant of \$621,000 from the National Science Foundation has been used for curriculum and materials development, and for staff training.

District and State Context

The Detroit Public Schools' efforts to serve highly able students were first organized in 1984, when a Gifted/Talented Task Force was convened to develop a philosophy and strategies for serving students. Since 1984, the district has initiated a number of programs that are designed to identify the variety of gifts and talents possessed by children living in a complex, urban environment. These programs include early identification processes, middle school enrichment programs, and specialty high schools.

As an independent organization with ties to the DPS, DAPCEP operates as one of the district's enrichment programs. DAPCEP's philosophy of serving a broad range of students, and of providing them with multiple sources of support, is consonant with DPS's recently-developed gifted and talented program.

DAPCEP's model also reflects the State Education Department's emphasis on serving high risk youth who are highly able, particularly by providing sustained support as an adjunct to a regular academic program. Finally, DAPCEP's efforts to work with business, industry, and universities are in keeping with the state's initiatives in promoting partnerships between the private and public sectors.

DAPCEP's Impact

DAPCEP has been effective in reaching its goal to encourage program participants to pursue post-secondary study in science and engineering. The program has been successful in developing students' abilities to conduct systematic, scientific research. Each of these is discussed below.

Pursuit of Post-Secondary Study. In an effort to determine the success of DAPCEP's graduates, the program conducted a mail survey of

all known graduates in 1986. Ninety-six former DAPCEP students who graduated from college and 488 students who currently are enrolled in college responded to the survey. Of the 96 college graduates who responded to the survey, 84 (88 percent) students majored in science or engineering. Seventy-six percent of these students pursued engineering, 11 percent majored in computer science, and the remaining students studied science. The pattern is similar for those students currently attending college. Of the 488 respondents, 396 are majoring in science or engineering, with the majority (66 percent) pursuing engineering. These findings are presented in Table 4.

Table 4

PROFILE OF DAPCEP GRADUATES PURSUING POST-SECONDARY
STUDY IN SCIENCE AND MATHEMATICS

Field of Study	DAPCEP College Graduates		DAPCEP College Enrollees	
	Number (n=96)	Percent (%)	Number (n=488)	Percent (%)
Computer Science	9	9	44	9
Engineering	64	67	262	54
Physics/Math	1	1	13	3
Science	10	10	77	16
Other	12	13	92	18

Development of Research Skills. A major emphasis in DAPCEP's middle school pre-engineering curriculum is the development of students' ability to understand and carry out the scientific method. A mechanism that is used to teach this skill, and to motivate students to achieve, is the Metropolitan Science Fair. In this event, the winners

from local science fairs held in Detroit and its surrounding counties compete for awards.

In 1977, the Detroit Metropolitan Science Fair had a total of 2,438 entries. Of these, 222 were from the Detroit Public Schools, including 26 from DAPCEP. By 1982, DAPCEP had increased its percentage of the DPS entries to 75, which has been sustained over time.

Not only has DAPCEP encouraged its students to enter the Science Fair, but the program also has prepared students to compete successfully. For example, the highest awards given in the Metropolitan Science Fair are the Grand Award and Gold Ribbons. In 1977, DAPCEP students received only two Gold Ribbons and no Grand Awards. During the period 1977-1987, DAPCEP students increased their competitive abilities, such that students have won four Grand Awards during this period, and in 1987, DAPCEP students won 61 percent (300) of all Gold Ribbons.

Program Transferability

DAPCEP's success in serving its target population, in providing highly able, minority students with opportunities for academic enrichment and acceleration, and in sustaining itself as a functioning organization, can be attributed to a number of factors. Of primary importance has been the program's philosophy of casting a "wide net" in recruiting students, in an effort to reach highly able students who normally would not be identified as having potential. In providing its variety of academic enrichment activities, DAPCEP has worked closely with the Detroit Public Schools to ensure that DAPCEP programs enhance, as well as supplement, the district's efforts. DAPCEP's focus on preparing middle school students for careers in science and engineering fills a gap that is critical to the development of these students.

Another important factor in DAPCEP's success has been the ability of the executive director and staff to work closely with the Board in creating and implementing programmatic initiatives. The participation of business, industry, higher education, the community, and the Detroit Public Schools has been essential to the organization's growth.

As a multi-component model, DAPCEP can be replicated in part or in its entirety. Although DAPCEP is a non-profit organization that operates independently of the DPS, this structure is not necessary for replication. The model could function as a special program within a school district, with a director responsible for program operations. Regardless of the program's organizational status, the success of the replication would be dependent upon the program director's capabilities to garner support from business and higher education in order to offer DAPCEP's varied enrichment activities.

VII. CHICAGO PUBLIC SCHOOLS GIFTED AND TALENTED PROGRAM

Introduction

The Chicago Public Schools (CPS) Gifted and Talented Program provides a variety of accelerated and enrichment activities for the city's 22,000 highly able students. For elementary and middle school students, six regional centers throughout Chicago offer an accelerated program that covers all academic content areas, including specific programs in mathematics and science. Academic centers provide a college preparatory curriculum for students in grades 7-12. A number of enrichment activities--museum programs, fast-paced programs, and summer programs--also are available for the district's highly able students.¹

The vast array of programs for highly able students is administered by CPS's Gifted Program Office in the Bureau of Gifted and Talented, one of nine bureaus under the Department of Pupil, Personnel and Special Education Services. The Administrator of Gifted and Talented Programs, Richard Ronvik, oversees all programs in the city's school districts, with the assistance of five regional gifted coordinators. In addition to the coordinator, each regional office, serving five school districts, is staffed by one psychologist, one social worker, and two teachers, who act as substitutes when other teachers of the gifted are receiving inservice training. Area educational service centers support gifted field office work and teacher training for the gifted. Also, a coordinator for off-campus programs administers the museum and fast-paced programs. The Gifted Program Office assists schools in the development of gifted programs (including the establish-

¹CPS offers a wide variety of program options to its highly able students--ranging from magnet schools to local gifted programs. The total offering includes 12 magnet schools, an International Baccalaureate Program, 12 off-campus museum programs, seven fast-paced programs for elementary students, and 537 local gifted programs. This case study focuses on a select sample of these programs, which provide students with opportunities to develop their mathematics and science abilities. These programs are: academic and regional centers and the all-city programs, which include the museum programs, fast-paced programs, and summer programs.

ment of selection criteria); provides inservice workshops for gifted program teachers; and helps schools to obtain instructional materials and supplies for gifted programs.

Development of a System-Wide Strategy

Historically, CPS has provided special programs to its highly able students. Over time, it has strived to serve gifted students across all grade levels. Until the 1970s, CPS offered primarily pull-out programs for elementary students that had an open enrollment policy. Resource centers across the system provided instruction to students one day a week for a full-day program; utilizing the Renzulli model of enrichment. However, staff found these centers to be ineffective because they met the needs of gifted students on a part-time basis only, returning students to regular classes for 80 percent of their time in school. The resource centers were phased out and eventually replaced by regional centers--special accelerated and enriched programs for gifted elementary students in CPS. The first comprehensive, full-time center was opened in September of 1979. Also in the 1970s, academic centers were established for highly able students as an alternative to the traditional comprehensive high school. The academic centers were designed to provide an accelerated, broad-based, college-preparatory curriculum to gifted students in grades 7-12. One of the three all-city programs--the museum programs--also began at this time. The Education Director of the Field Museum of Natural History submitted a proposal to the Gifted Program Office to begin a museology program at the museum. The program was implemented and was considered to be highly successful. Over time, the number of museum courses grew, as did the number of participating cultural institutions (Maxwell, 1980).

Concurrent with the development of the various gifted programs, student selection criteria were established and refined. Prior to the 1970s, each school within the system had developed its own criteria for admission into gifted programs, and these varied considerably across schools. Also, prior to the federal desegregation order in the 1970s, students were admitted into the CPS's gifted programs without regard to

race (although many minority students participated in local gifted programs at all-black schools). Once the desegregation order was issued, selection of students for gifted programs was based on students' racial background, as well as their academic qualifications. More integration occurred at individual programs, such as the regional centers. In 1985, the state mandated that all districts utilize a minimum of three criteria when selecting students for gifted programs (Illinois State Board of Education, 1985). This requirement has reduced variability in student selection across Illinois, as well as within individual districts. CPS has maintained and consistently enforced high standards in the selection process, which has not hindered its ability to attract a diverse student population in terms of race, ethnicity, and socioeconomic status.

Over time, the Gifted Program Office has experienced a shift in focus with respect to identifying, selecting, and serving its target population. Beginning in the 1960s, the office concentrated its efforts on developing programs for gifted students at the elementary level because of the strong conviction that early identification was crucial to the maximum development of gifted and talented children. Furthermore, existing courses and honors programs at the high school level provided options for gifted students. Currently, CPS is expanding its efforts to provide comprehensive programs for students that would start at grade 9 and continue through grade 12.

Of the 22,000 students currently served by gifted programs in CPS, 78 percent are in grades kindergarten through 8, while 22 percent are in grades 9 through 12. Fifty-five percent of the students are female and 45 percent are male. Fifty-one percent of the gifted students are black, 27 percent are white, 12 percent are Hispanic, and ten percent are Asian (Byrd, 1987). Sixty-eight percent of all students in CPS are below the poverty level, as determined by participation in the federal school lunch program. Further, approximately 25 percent of the students attending the regional centers are eligible for the school lunch program. Approximately 1,400 gifted students attend the six regional

centers; another 1,500 gifted students attend the three academic centers. The all-city programs attract approximately 500 students.

The Gifted and Talented Program

The primary goal of CPS's Gifted and Talented Program is to provide highly able students with a variety of accelerated and enriched experiences that will challenge them to the limits of their academic potential. Together, the regional and academic centers and the all-city programs equip students with the tools and resources necessary to accomplish personal, professional, and academic goals commensurate with their abilities.

Students are admitted into the regional and academic centers on a competitive basis. Three categories of criteria are used in the selection process, which complies with State Education Department's gifted guidelines: 1) performances on reading or verbal tests; 2) performance on aptitude, achievement, subject matter, or creativity tests; and 3) results of teacher evaluation, past school performance, or quality of a student's product. Gifted Program coordinators and psychologists who oversee the centers within their region have final responsibility for selecting program participants. For the most part, selection decisions are firm and cannot be appealed. However, a student may reapply for admission in later years.

Regional Centers. Regional center program participants are nominated by the school system's kindergarten teachers, who select their top two to four students for gifted program testing in the spring. After a period of observation, each kindergarten teacher completes and submits to the Gifted Program Office a checklist of observed behaviors, which notes the degree of presence of certain behaviors in each child. The behavioral checklist is a screening mechanism for identifying potential program participants. Students also may be referred for testing by psychologists, social workers, and parents. In early April, approximately 1,000 students citywide are tested for 150 placements at six regional centers which have the following total enrollments: Alexander Graham Bell (250); Luther Burbank (375); Annie Keller (180);

762

Thomas Edison (240); Ted Lenart (250); and A.N. Pritzker (180). Usually, a cognitive or general abilities test is administered (achievement tests are not used because of their cultural bias), and the tests vary from year to year. Currently, the Cognitive Abilities Test (COG) with subtests, and the Raven Advanced Progressive Matrices Exam, a non-verbal reasoning test, are being administered. Student scores are ranked in descending order and a selection is made based upon a composite numerical score and the race of the child. The centers must comply with CPS's desegregation order; some centers mandate 50 percent minority/50 percent majority, while others mandate 65 percent minority/35 percent majority. Generally, students enter a regional center at first grade and continue through eighth grade (although two centers currently accept students at the kindergarten level).

The regional centers provide a full-day academic program that covers a wide range of subjects, including mathematics, science, language arts, and the humanities. Some of the regional centers have a mathematics/science emphasis (Gifted Program Office, n.d.). For example, Keller offers Aerospace in grade 5 and Laboratory Biological Science in grade 6. The Ted Lenart Center has an extensive computer studies program that includes instruction in BASIC programming, word processing, and LOGO language. Generally, the centers offer more subjects than are available in the regular elementary program. In addition, the courses at the centers are taught at an accelerated pace and are more advanced in content than those at home schools. For example, the social studies component of Bell's core curriculum includes introductory courses in anthropology and sociology; history; philosophy and art; and architecture and music from a historical perspective--all of which are taught at a faster pace and some of which are not taught at all at home schools. Center students are expected to accomplish eight years of the Chicago Board of Education's curriculum in six years. Grades 6, 7, and 8 are devoted to advanced study of various subjects at the high school level (e.g., algebra, laboratory science, and foreign language). The program is full-time, and students attend five days a week, 9:00 a.m. to 2:30 p.m. Students also may

participate in extra-curricular activities, including special teams, clubs, and self-help labs.

The regional centers (as well as the academic centers) are staffed by teachers who are selected based on their knowledge of the subject matter, as well as their experience and training in working with gifted students. Currently, the state requires that all professional gifted program personnel hold registered teaching, supervisory, or administrative certificates, and have either special education training, or experience in working with the gifted.

Academic Centers. Highly able students in grades 7-12, who meet specified program criteria, may attend the academic centers. All students in CFS are required to take the Iowa Test of Basic Skills (ITBS) annually; a student scoring in the eighth stanine or higher in reading comprehension and mathematics may be considered for admission into an academic center. In the sixth grade, a prospective student must take two entrance examinations: the ninth grade level California Achievement Test in reading and mathematics; and the Raven Advanced Progressive Matrices Exam. These test scores, along with a student's grade point average, are used to compute a composite numerical score. This score, along with a student's race, determines a student's admission into the centers. Currently, the academic centers have the following total gifted program enrollments: Whitney Young (590); Kenwood Academy (550); and Morgan Park (440).

Students at the academic centers are immersed in a college-preparatory curriculum that includes intensive, accelerated instruction in English, social studies, mathematics, laboratory science, and foreign language. In grades 11 and 12, students engage in college-level coursework in Advanced Placement classes. Of the three centers, Whitney Young has an emphasis in mathematics/science, in which students pursue these subjects in greater depth. A student pursuing a mathematics/science concentration at Whitney Young would take Algebra I and Biology in grade 9, Geometry I and Chemistry in grade 10, Algebra/Trigonometry and Physics in grade 11, and College Algebra/Analytic Geometry and an AP science course or science elective in grade 12 (Whitney M.

Young Magnet High School, 1987). The academic center program is full-time, five days a week. Counseling services, clubs, and student competitions supplement the curriculum.

Museum Programs. The museum programs serve highly able students in grades 7, 8, 11, and 12. At the elementary level, a student must meet the following criteria in order to be screened for the programs: 1) read above grade level; 2) have a minimum of a B average; and 3) be recommended by a teacher. Final selection is based on stanine scores and an Academic Talent Search using the Scholastic Aptitude Test. To be screened for a secondary-level program a student must: 1) be in the upper 10 percent of his/her class; 2) have a minimum of a B average; 3) have above-average Test of Academic Proficiency scores; and 4) be recommended by a teacher. Final selection is based on grade point average, class rank, and a consideration of the racial composition of the total class. Up to 25 students from each school can participate in a single museum program.

Currently, the Gifted Program Office sponsors 12 museum programs in conjunction with 11 local cultural institutions. Several of the programs have a science emphasis, including courses in astronomy, zoology, ecology, aquatic science. In addition, all of the programs include a study of the museum as an institution, along with a study of the museum's collection. All students have an opportunity to research, document, and analyze topics related to the museum's holdings. Much of the curriculum involves hands-on activities--either exploring the museum's current exhibits, participating in field trips, or bringing specimens into the classroom. Only two of the museum programs use a textbook.

Museum staff teach the courses and determine the curricula, which must comply with broad guidelines set by the Gifted Program Office (Board of Education, n.d.). Museum personnel are not required to have any special education or gifted program training; however, many have had prior teaching experience in addition to their subject area of expertise.

The classes meet one afternoon a week for an entire year at the museum. High school students receive academic credit for the program; elementary students are graded on their work.

Fast-Paced Programs. Gifted students in grades 7 and 8 who meet the criteria for the Academic Talent Search are eligible for the fast-paced programs. After approval from the elementary or middle school principal, the Gifted Program Office sends a letter and application form to students who have been selected by the Academic Talent Search. These students have scored in the 95th percentile on the ITBS and also have taken the Scholastic Aptitude Test, receiving a minimum score of 400 in Mathematics and 375 on the Verbal test. As of January 1988, 108 highly able students participated in the fast-paced programs.

Students in these programs may enroll in accelerated courses at five local colleges and universities--Northeastern Illinois University (Biology and Algebra), University of Illinois (Algebra), Chicago State University (Computer Studies and Language Arts), Loyola University (AP Latin), and Roosevelt University (Social Studies). The classes, which are taught by college faculty, meet one day a week, one hour a session, for an entire school year. In many cases, these classes supplement a student's full-time participation in a local school gifted program.

Summer Programs. The summer programs are primarily for those students attending the regional and academic centers, although some programs are open to regular high school students. There are orientation sessions for gifted elementary students attending regional centers; enrichment programs in certain topic areas; and skills preparation programs (e.g., vocabulary development, test-taking, word processing, report writing, and library science). For secondary students, there are curriculum offerings at the academic centers and enrichment programs. Finally, both elementary and secondary students participate in collaborative programs with local museums, colleges, and universities (Ronvik, 1988).

Support Services

In an effort to address the individual needs of highly able students, CPS provides these students with counseling and other support services through field office teams of psychologists and social workers. Each of the gifted field offices has one psychologist and one social worker to serve the five districts in its region.

The team approach to counseling--involving both psychologists and social workers--was initiated by the Administrator of Gifted and Talented Programs in 1971, in order to provide better counseling services to gifted students. Through the use of a team approach, gifted students who are having problems can receive specialized help on issues such as their placement in appropriate programs.

Currently, the teams--with the assistance of the gifted coordinators--work with individual gifted students; recruit students for special programs; establish identification procedures; provide inservice training for teachers and administrators on identifying and selecting gifted students; and initiate and follow up community agency referrals. The teams visit area schools regularly, and provide counseling to students and their families on an as-needed basis (Board of Education, 1982).

Parent Involvement

Gifted Program staff attempt to involve parents in every phase of services provided for gifted students, including student selection, program planning, support services, and program evaluation. After a gifted student has been identified by a kindergarten teacher for testing and possible admission into a regional center, a parent must complete and submit an application form. Also, if a student has been overlooked in the identification process at the elementary level, a parent may request that he/she be screened. Parents are brought in to confer with teachers regarding program options when their child is having difficulty in a particular gifted program. In addition, parents are eligible to receive counseling services provided by the field offices' psychologists and social workers. Finally, parents are invited

to open houses sponsored by the all-city programs. Gifted Program staff attempt to maintain regular telephone contact with families throughout the year, as a substitute for in-person visits.

Program Funding and Administration

Funding. Currently, gifted programs in the Chicago Public Schools receive funds from federal, state, and local sources. In 1987-88, federal funding included \$25,000 from Title II of the Education for Economic Security Act (EESA), and \$158,000 from Chapter II of the Education Consolidation and Improvement Act (ECIA). The majority of program funding comes from the state through the Illinois Gifted Reimbursement Program (IGRP) and the Illinois Educational Service Center (IESC); currently, \$2.3 million in IGRP funds and \$316,000 support Chicago's gifted programs. In addition, the school board contributes approximately \$19,000. Prior to 1987-88, local support was nonexistent, and the state was the primary funder, contributing about \$2 million to the programs. Over the past few years, federal support from both EESA and ECIA has totaled approximately \$175,000. Generally, funding for Chicago's gifted programs has been between \$2.2 million and \$2.8 million annually.

Administrative Functions. The Gifted Program Office manages the program's budget as part of its overall administrative and supervisory responsibilities--a role that also entails data collection. The Gifted Program Office collects routine demographic data as well as case record information on individual students. Specific data concerning highly able, disadvantaged students are collected regularly. These include AP test results (by subject area) for all schools throughout the city; ITBS scores (by subject area) of students attending regional centers; and honors or awards (e.g., SAT scores, contest winners) of outstanding 7th and 8th grade students attending regional or academic centers.

Every year the Gifted Program Office presents this evaluation data in a report to the state--a requirement for receiving IGRP funds. A consultant in gifted education with the Illinois State Board of Education monitors gifted programs throughout the state and provides

technical assistance to schools and districts in the area of curriculum development.

In a state that does not mandate gifted and talented programming, 915 districts out of a total of 976 serve 86,000 gifted students through special programs. There is wide variation in programs throughout the state, with pull-out programs being the most common type at the elementary level, and with honors and AP programs dominating the secondary school effort. Regardless of type, all Illinois gifted programs must adhere to broad state guidelines. Each program must: 1) include curriculum adaptations to teaching methods for gifted students; 2) utilize specific identification/selection procedures; 3) provide activities for gifted students that are distinct from those offered in the regular classroom; 4) involve each gifted student in at least 150 minutes of weekly special activities during the regular school year; and 5) undertake systematic evaluations of the program (Board of Education, 1987).

CPS's gifted programming follows the above guidelines. In a school system with diverse options for gifted students, there are opportunities for a student's continuous progress in a gifted program. Because of the multitude of programs and the vastness of this urban area, the Gifted Program Office alerts families to the availability of program options for their children and how students can be admitted into these programs. Also, the psychologist and social worker teams identify underachieving gifted students, track their progress, and refer them to the appropriate program. If a student is having difficulty in a particular gifted program, an effort is made by local school or field office staff to "counsel out" the student and find an alternative placement. Staff try to monitor the child in his/her new academic setting for another year.

Program Impact

Chicago's Gifted and Talented Program has been effective in promoting student achievement in mathematics and science, in enhancing student attitudes, and in exposing students to mathematics and science.

Each of these outcomes is discussed below, along with the relevant supporting data.

Student Achievement. Regional and academic center students obtain higher scores on standardized examinations in mathematics and science than students at comparable grade levels attending the Chicago Public Schools. The data presented in Tables 5 and 6 illustrate these outcomes.

Table 5 presents the ITBS mathematics scores of students attending the Alexander Graham Bell Regional Center, compared with scores of students attending the CPS. Center students received higher scores than their peers across all grade levels.

Table 6 compares the percentage of students from the three academic centers who score three or higher on the AP mathematics and science exams with the percentage of students at other schools within the city who took the same AP exams. In most content areas, the percentage of center students scoring three or higher on the exams is at least two times that of other high school students. It is important to note that Whitney Young is the only academic center that offers all four of the mathematics and science AP exams listed in Table 5, and, although Kenwood Academy offers AP in just two mathematics and science content areas--Calculus and Biology--100 percent of its students scored three or higher on the Calculus exam, and 80 percent of its students received comparable scores on the Biology exam.

Attitudinal Data. Student and parent evaluations conducted in 1986-87 revealed an increase in students' awareness about the museum programs and the subject matter addressed in these programs. For example, students participating in the museum programs said that they felt positive about museums and their collections as a result of the program. Further, the programs increased students appreciation of the content area and enabled students to work independently more often than in the regular classroom. Parents of children who attended the museum programs said that their children benefited "a lot" from the program, and that the content was new and different from material learned in the regular classroom (Maxwell, 1987).

Table 5

ITBS MATHEMATICS SCORES
OF REGULAR AND GIFTED STUDENTS
Spring 1987

Grade Level	Mathematics Scores					
	Regular Students			Options (Gifted) Students		
	Median	Range	Years Above Grade Level	Median	Range	Years Above Grade Level
1	2.2	1.5 - 3.2	.4	3.1	2.0 - 4.0	1.3
2	3.3	2.0 - 5.1	.5	3.6	2.6 - 5.4	.8
3	4.0	2.5 - 5.7	.2	5.5	4.6 - 6.4	1.7
4	4.9	3.1 - 7.4	.1	6.8	5.9 - 7.5	2.0
5	6.3	4.2 - 8.1	.5	8.0	6.7 - 9.2	2.2
6	6.9	4.8 - 8.6	.3	9.4	7.5 - 10.6	2.6
7	8.2	6.7 - 10.6	.4	10.5	8.7 - 11.7	2.7
8	9.0	7.3 - 10.8	.2	11.8	10.5 - 13.0	3.0

Source: Bell School ITBS--Spring 1987

Table 6

COMPARISON OF ACADEMIC CENTER AND HIGH SCHOOL STUDENTS
WHO SCORE THREE OR HIGHER ON AP EXAMS
1986-87

AP Exam	Percent Academic Center Students Scoring 3+	Percent Other High School Students Scoring 3+
Mathematics:		
Calculus	86%	32%
Science:		
Biology	66%	26%
Chemistry	58%	35%
Physics	54%	25%

Source: Chicago Public Schools, Gifted Program Office, November 1987

Program Transferability

CPS's Gifted and Talented Program is a multi-faceted effort that provides students with a variety of opportunities to develop their overall talents, as well as specific skills in mathematics, science, and other subject areas. Each of the program's three components discussed in this case study--regional and academic centers, and all-city programs--has potential for replication by other school districts, given that certain organizational, staffing, and financial conditions can be met. These are: 1) ability to provide a central administrative office to manage the gifted program components; 2) availability of professional staff--e.g., psychologist, social worker--to provide specialized counseling to highly able, disadvantaged students; 3) capacity to provide self-contained programs, such as the regional and academic centers, which require separate facilities, specialized teaching staff, and transportation for students; 4) presence of a local museum to provide staff and facilities for a museum program; 5) availability of a local college or university to share staff and facilities for a fast-paced program; and 6) availability of stable funding sources to support all programs.

While the replication of the three components would enable a school system to provide students with opportunities for continuous progress, each individual component enhances a system's capacities to serve highly able students. Of particular note are the mechanisms that the Gifted and Talented Program staff has developed to meet the needs of economically disadvantaged students who must overcome cultural, geographical, and financial barriers to participate in specialized school programs.

VIII. ENCENDIENDO UNA LLAMA
(Hartford, Connecticut)

Introduction

Encendiendo Una Llama, an identification and enrichment program for grades K-6, serves highly able disadvantaged, bilingual students in the Hartford, Connecticut Public Schools. As a component of the Hartford Public Schools' Gifted and Talented (G&T) Program, Encendiendo Una Llama's mission is to develop bilingual students' academic gifts and creative talents so that they can qualify for the district's monolingual G&T program. As stated in the English translation of the program's name, Llama attempts to "light the flame" of bilingual students by helping them to master their linguistic skills as they expand their academic knowledge.

Hartford's education system provides specialized programming for gifted and talented students in 20 of its 30 schools. Llama's bilingual program is offered in three of the elementary schools with the greatest concentration of Hispanic students. Of the approximately 200 students who participate in Encendiendo Una Llama yearly, 78 percent are Hispanic, 13 percent are black, four percent are white, and one percent are Asian. In addition to serving a minority student population, the program also reaches economically disadvantaged children, with 80 percent of its participants eligible for the federal free and reduced lunch program.

Development of a District Strategy

Hartford Public Schools' services to gifted and talented students first began in 1958. The original effort was a self-contained, full-time program for elementary students, which emphasized acceleration in academic subjects. Students were selected for the program based on their IQ score, and they were assumed to be gifted in all content areas. In 1977, the program's structure changed to a part-time, resource room model, in which classroom teachers identify gifted and talented elementary students based on their performance in class and on achievement and creativity tests.

In 1979, the Hartford Public Schools became concerned that the district's increasing numbers of Hispanic students were infrequently admitted into the G&T program. With funding from the federal Office of Gifted and Talented Education, interviews with community representatives were conducted to identify the barriers to Hispanic students' participation in the G&T program. A number of conditions were uncovered that appeared to limit students' capacities to develop their academic skills and creative talents, such as their limited English proficiency, high family mobility that interrupts a child's normal development, and the lack of educational resources in the home due to parents' economic disadvantage. In addition, community members suggested several factors about the urban environment that could contribute to a child's academic development, such as the availability of cultural resources and the lack of store-bought toys that could stimulate children's creativity to invent toys from materials in their surroundings (Barstow, 1986).

Given these findings, the gifted and talented program director worked with district staff to design a program for highly able disadvantaged elementary students known as Encendiendo Una Llama. Using the district's definition of gifted and talented students as those with extraordinary learning ability and/or outstanding talent in the creative arts, the program identified students both in terms of their academic abilities and their creative talents. Since Llama's intent was to maximize students' capacities to be admitted into the district's G&T program, it began in a bilingual school and emphasized the development of children's linguistic skills as well as their academic gifts and talents. Using a pull-out, resource room model, Llama provided enrichment to students both during the school day and in an after-school program. As interest in Llama grew, it expanded to other schools in the district.

Encendiendo Una Llama

Identification Process. Limited English proficient, highly able, elementary students attending Hartford's public schools are the focus of the program's identification efforts. In order to reach a broad

range of bilingual students who have the potential of being identified as gifted and talented, Encendiendo Una Llama utilizes a modified version of Renzulli's "Revolving Door Identification Model." This process has three stages: 1) open recruitment; 2) development of a talent pool; and 3) formal identification (Barstow, 1986).

During the open recruitment stage, teachers, administrators, and parents from the three Llama elementary schools--Barnard-Brown, Burns, and Kinsella--solicit nominations for program participants. Classroom teachers complete a preliminary referral form, in which they record the following information about prospective participants: a) performance on standardized tests (Metropolitan Achievement Test, Comprehensive Test of Basic Skills/Espanol, and the Torrance Test of Creative Thinking); b) accomplishments in competitive events (e.g., science fair, art show, and spelling bee); and c) teachers' observations of students' skills and talents. Although most referrals are made at the beginning of each school year, additional referrals can be made throughout the school year.

The second stage of the identification process is the development of a talent pool. The bilingual resource teacher at each Llama school reviews the referral forms completed by classroom teachers and forms a list of the nominated students who show potential for being identified as gifted and talented. This list, which is the talent pool, generally includes from 10 to 15 percent of the total school population. Encendiendo Una Llama's use of the talent pool is a strategy for reaching a range of limited English proficient students, especially those who are economically disadvantaged and who otherwise might not be identified as having potential.

Students who are in the talent pool receive program services in the form of a "trial participation." Resource teachers in the three Llama schools conduct enrichment activities in which students work in small groups or on individual projects. These resource room activities provide students with opportunities to improve their linguistic skills, and develop their academic abilities and creative talents. For students with limited English proficiency, the development of linguistic skills is critical to their success in the G&T program.

During the "trial participation" period--which may last the whole school year--resource teachers collect detailed information to determine which students can qualify for the district's gifted and talented program. They observe students performing tasks in the resource room, and interview students and their parents to learn about their children's strengths and weaknesses. Since the majority of Llama students have limited proficiency in English, the student and parent interviews often are conducted in Spanish. This flexibility in information gathering enables teachers to orient students to program procedures, and to explore parents' perceptions of their children's abilities.

The third stage of the process is the formal identification of students as academically gifted or as artistically talented. During this stage, resource teachers compile a cumulative record on each student in the talent pool, which includes information about students' academic and artistic abilities. A Planning and Placement Team (PPT), composed of the resource teacher, the school principal, and parents, meets to review the cumulative record of each student to determine whether he/she is qualified to enter the district's monolingual G&T program. Students being considered as academically gifted are reviewed in terms of their achievement test performance (i.e., results of the Metropolitan Achievement Test, Cognitive Abilities Test, and the Torrance Test of Creativity), class grades, language development, and teachers' estimation of their performance. Students with artistic talents are examined for their creativity and artistic talent rather than for their academic ability. The PPT assesses students' creative abilities through a review of special projects and artistic performances, and solicits recommendations from music and art teachers. The PPT process, which is used by the Hartford Public Schools to formalize the identification of gifted students, takes place at any time that the school personnel feel it is warranted in grades 3-6. The major impact of being formally identified is that these students automatically remain in the program year after year, whereas the rest of the talent pool students are reviewed at the beginning of each year.

Once students are formally identified either as academically gifted or artistically talented, the PPT develops an Individualized

Educational Program (IEP) for each student, which outlines the various services the Hartford Public Schools must provide identified students until they graduate or leave the school system. Talent pool students not identified formally through the PPT process may receive program services in the resource room until the end of the school year, at which time their progress is reviewed by the resource teacher, who determines whether they will be retained in the talent pool for the following year. Students who show sufficient progress to be retained in the pool have an opportunity to qualify for the district's G&T program the following year.

Instructional Program. Students in Llama's talent pool receive academic enrichment through activities offered in a resource room, the regular classroom, and after-school sessions. Students at the three Llama schools participate in a pull-out, resource room program for 1.5 hours per week. Each resource room is staffed by a full-time bilingual teacher, who provides three types of instructional activities based on Joseph Renzulli's "Enrichment Triad" model: 1) enrichment; 2) skill development; and 3) independent projects. Activities that emphasize the development of linguistic abilities as well as higher order thinking skills are offered in small group settings. Working alone or in small groups, students undertake special projects in areas including science and computers. For example, during the 1986-87 school year, students initiated independent projects on the topics of robotics, solar systems, air flight, and the human body. Llama students work with computers, donated by the Apple Education Foundation, to learn geometric relationships, write programs in BASIC and Logo, and access weather data to develop forecasts.

In addition to participating in resource room activities, Encendiendo Una Llama students receive accelerated instruction in their regular classrooms. Resource room staff help classroom teachers learn how to provide appropriate instruction for gifted and talented students, using resource room materials. Classroom teachers build upon the activities conducted in the resource room, in an effort to reinforce the linguistic and academic enrichment provided to Llama students in the pull-out program.

Until federal funding ended, the third instructional component in Llama was an after-school program, which was offered four days each week, Monday through Thursday. Specially trained classroom teachers worked with students to enhance their academic skills and creative talents in specific content areas, such as mathematics, science, music, and art. Instructional activities were similar to those provided in the resource room, and included exploration activities involving speakers and field trips; group training activities to build skills such as critical thinking; and individual and small group research projects.

Parent Involvement

Parent participation is a critical component of Encendiendo Una Llama. By including parents in program activities, the Llama program encourages families of gifted and talented students to provide educational opportunities at home and to utilize community resources to foster their children's intellectual development.

Parents support the Llama program in a variety of ways. As members of the district's Planning and Placement teams, parents participate in the formal identification of gifted and talented students. For example, during the 1986-87 school year, Llama parents participated in 26 PPT meetings. Llama also hosts open houses during the year, which provide opportunities for parents to meet with teachers and observe their children demonstrating their talents. In order to provide parents with continual feedback about their children's progress, resource teachers make home visits and communicate with parents through telephone calls and letters. Finally, the program facilitates parents' involvement in enrichment activities. For example, during 1986-87, parents participated in 11 field trips to sites such as the Science Museum of Connecticut, the Hartford Public High School Planetarium, and Project Oceanology (Hartford Public Schools, 1987).

Program Staffing

Encendiendo Una Llama is administered by a program director, Daniel Barstow, who also is the director of Gifted and Talented Programs for the Hartford Public Schools. Resource room teachers and classroom teachers implement Llama's instructional programs at the three school sites.

Llama, in conjunction with the district, provides training for all staff who carry out its various components. At the beginning of the identification process, classroom teachers, administrators, and other school personnel attend an orientation session to review Llama's identification procedures. During this session, participants learn about the characteristics of gifted and talented children, and the special cultural and linguistic factors that affect the district's highly able students.

The resource room staff, who are selected for the program based on their experience as bilingual teachers, receive a combination of pre-service and inservice training to prepare them to work with Llama students. Through summer workshops, after-school sessions, and university courses, resource staff are trained in methods for instructing gifted and talented, disadvantaged students.

Regular classroom teachers attend an initial orientation about the district's gifted and talented program and have the option of participating in training sessions that focus on specific topics related to bilingual, highly able students. Teachers who implement Llama's after-school component attend a one-week, pre-service orientation session, and meet periodically to discuss progress and problems.

In addition to their instructional responsibilities, regular classroom and resource room teachers are members of Enrichment Teams. Team members plan and coordinate the gifted and talented activities at each Llama school, with a special emphasis on enrichment in the regular classroom.

Funding and Administration

Funding. Encendiendo Una Llama's initial funding in 1979-80 was a one-year grant from the U.S. Department of Education, Title IV, Part C

of P.L. 93-380. From 1981 to 1987, the program was supported by the U.S. Department of Education's Title VII Bilingual Education funds (an average of \$170,000 per year) and district monies (\$20,000 per year). Currently, the state reimburses the district for up to 67 percent of the local costs of serving the gifted and talented students. State funds first are given to the City of Hartford, which allocates a portion to the district. The district then allots an amount to Encendiendo Una Llama. In 1987-88, Llama was supported by approximately \$75,000 of Chapter II funds and another \$40,000 in district funds.

Program Administration. Encendiendo Una Llama is administered as part of Hartford Public School's Gifted and Talented Program, which operates under the district's Instructional Support Services Division. As a special program in the district, Llama has influenced the formation of the district's elementary program for highly able, disadvantaged students, particularly those with limited proficiency in English.

The development of Hartford Public Schools' services to gifted and talented students has been consistent with the state's mandate for gifted and talented education, which does not prescribe the provision of specific programs. Through the implementation of Encendiendo Una Llama, Hartford has become a leader in the state in the use of the three-stage identification process, which has been adopted by districts both within and outside of Connecticut.

Articulation

Once Llama students complete grade 6, they are eligible for the district's monolingual gifted and talented program in middle and secondary school. Middle school students admitted into the district's G&T program enroll in special courses designed to build their research and higher order thinking skills, such as Independent Work and Study Skills in grade 7, and Communication Skills in grade 8. High school students also take special courses, such as Critical Thinking Skills in grade 9, and Creative Problem Solving in grade 10. In addition, students may enroll in honors and Advanced Placement courses at the secondary level.

Program Impact

Encendiendo Una Llama has been effective in providing elementary gifted and talented students with the requisite skills to gain admission into the district's monolingual program. Thirty-three percent of Encendiendo's 1986-87 graduates were admitted into the district's gifted and talented program in middle school. Further, 100 percent of these students were retained in the G&T middle school program, signifying the program's ability to identify accurately gifted and talented students at the elementary level.

Program Transferability

The Encendiendo Una Llama model can be used by school districts in a monolingual or bilingual program. Adoption of the activity-based identification process along with the curriculum component is crucial. The three-stage identification process requires the services of a full-time resource teacher to form a talent pool and provide an enrichment program. To maximize the effectiveness of the instructional program, enrichment activities also must be offered in the regular classroom, and an after-school component that offers accelerated instruction to students should be implemented.

In order to operate a bilingual program, teachers must be available who have the capacity to provide instruction in English as a second language. It also is desirable to have staff training in gifted and talented instructional methods. Finally, the program must involve parents in as many ways as possible, to encourage their support of their children's academic and social development.

IX. THE POTENTIALLY GIFTED MINORITY STUDENT PROJECT (West Palm Beach, Florida)

Introduction

The Potentially Gifted Minority Student Project (PGP), sponsored by the Palm Beach County Public Schools, is a program aimed at identifying and serving fourth grade minority students with above-average abilities, who have potential for qualifying for the district's elementary gifted program. The program serves 144 students at nine elementary schools in the district, which has approximately 90,000 students and encompasses an area of over 2,000 square miles. Of the 4,500 students in the county's school system who have been designated as gifted, an estimated 3,000 are at the elementary level. Three hundred and sixty-five minority students are enrolled in the Palm Beach County Gifted Program.

Development of District Strategy

PGP was developed as part of a district strategy to increase the number of minority students enrolled in the district's gifted program. In 1978 the Associate Superintendent of Instruction for the Palm Beach County Public Schools, Dr. Joseph Orr, became concerned that only a very small proportion of minority students were among the county's gifted students. Dr. Orr worked with the district's gifted specialist to develop a program plan for preparing these students to perform competitively on the tests used for admission into the district's gifted program. Their plan called for the use of identification instruments and processes that would reveal a range of minority students' abilities and skills. The plan specified that the Structure of the Intellect (SOI) Test of Learning Abilities--based on Guilford's model--and teacher nominations would be used to identify potentially gifted minority students. The SOI Test of Learning Abilities assesses students' abilities in five major areas--cognition, memory, convergent production, divergent production, and evaluation--with questions pertaining to reading and mathematics. Once identified, students would be placed in a self-contained class for a year of accelerated instruction at their

grade level and for enrichment in critical thinking skills. This year-long program was designed to prepare minority students for possible admission into the district's program.

The PGP plan was presented to the School Board in 1979, which readily approved its implementation. With funding provided through the state's Alternative Education Act, the district initiated the PGP in five schools in 1980. The PGP operated as a third grade enrichment and acceleration program from 1980-1987. When the state funding source shifted from Alternative Education to Dropout Prevention monies in 1987, the PGP changed to a fourth grade program in order to remain eligible for state funds.

The Potentially Gifted Project

Program Objectives. The Potentially Gifted Minority Student Project is designed to provide highly able, minority students with an accelerated and supportive environment that will allow them to develop their thinking, learning, and problem-solving abilities and, as a result, qualify for the district's gifted program. In pursuit of this goal, the program has the following objectives:

- Fifty percent of participating students will register gains in hearing vocabulary for Standard English as measured by the Peabody Picture Vocabulary Test;
- Fifty percent of participating students will register gains of at least one grade level above entry scores on the Structure of the Intellect Test of Learning Abilities;
- Fifty percent of participating students in the program--when compared with previous year's Stanford Achievement Test (SAT) scores--will make gains in at least one of two areas: listening comprehension/vocabulary or mathematics; and
- Twenty percent of students in the program, at the end of the school year, will score at least two standard deviations above the mean on the Wechsler Intelligence Scale for Children-Revised (WISC-R).

To achieve these objectives, Palm Beach County Public Schools created an identification and enrichment program that provides differentiated instruction to students who are identified through multiple measures, including tests and observations. Originally designed as a third grade instructional program, students currently are identified as having potential in the third grade and are taught an accelerated curriculum, including critical thinking skills, during the fourth grade.

The PGP Identification Process. Students are admitted into PGP through an intricate identification and selection process, which is composed of three steps: 1) receipt of teacher nominations; 2) administration of the SOI; and 3) final review and selection of students.

Identification of highly able students occurs in grade 3. In the spring, third grade teachers from the 40 district elementary schools nominate students for the nine PGP school sites. PGP's Project Manager interviews third grade teachers to determine whether nominated students exhibit the following characteristics: 1) expresses him/herself well, either in writing or orally; 2) grasps new ideas and concepts quickly; 3) displays self-confidence; 4) gets along well with others; and 5) shows self-discipline. The nominating teachers must indicate on a checklist whether the student is above average in the class with respect to the five characteristics. Also, to qualify for participation in the project, a student must be from a minority group.

Once nominated, students are tested using the SOI Test of Learning Abilities. The SOI was selected due to its capacity to assess talents and skills in minority populations. Fourth grade teachers and the Project Manager administer the SOI at 40 of the elementary schools in the district. All students nominated at a school are tested as a group at their home school. Teachers are released for two days of testing, which lasts approximately 90 minutes per day. Nominated students are tested on nine sections of the SOI, and those scoring three years above their current grade level on five or more sections of the test are eligible to participate. In addition, students who have Stanford Achievement Test scores or grades that are significantly below expected levels as compared with their performance on the SOI may qualify for admission.

The list of nominated students at each PGP school site is reduced to 16 based on SOI and SAT scores and teacher interviews, and an additional four or five are placed on an alternate waiting list. The parents of children who qualify are invited to an evening information and orientation meeting to review the goals and objectives of the project. At this meeting, parents are asked to participate in the program by attending meetings and workshops held during the school year. Students then are assigned to the nine project schools according to the geographic proximity of their homes, and transportation routes.

Each year a total of 144 students is selected for participation in PGP (16 students for each of the nine school sites) out of a pool of 300-400 originally identified for testing. While the program receives funding for only 13 students per class, 16 are selected to accommodate student transiency during the year. The balance of ethnic and cultural groups represented in the project has remained fairly constant since the program's inception, with approximately 70 percent black students, 20 percent Hispanics, and 10 percent Asian and Middle Eastern students. The proportion of project students receiving federal free or reduced-price lunches is approximately 75 percent, while the district total is 29 percent.

Classroom Component. Once identified, PGP students are enrolled in a self-contained fourth grade class with a ratio of 15 or 16 students to one teacher and a full-time aide. During this year, students are taught the district's fourth-grade curriculum, and also receive one to one and one-half hours a day of enrichment in thinking skills. Instruction in the regular curriculum is accelerated in order to allow time for instruction in thinking skills, which is based on the concepts tested in the SOI.

Program instructors use Building Thinking Skills (Black, 1985) in teaching the thinking skills curriculum. Examples of topics addressed in the curriculum include: figural similarities and differences, figural sequences, figural classifications, verbal analogies, and verbal sequences. Prior to the introduction of the Black materials in 1983, project staff used materials developed by the SOI Institute and PGP's Project Manager (Howells, 1983). Thinking skills are taught both

during the period at the end of the school day, and as part of the fourth grade curriculum through various exercises. For example, a teacher might ask, "Why are we using multiplication? In what instances would we use it outside of school?"

Generally, the accelerated and enriched curriculum is designed to improve students' abilities to solve problems, to think independently, and to increase their self-confidence. Instruction also is aimed at remediating students' academic weaknesses and building on their strengths.

Manipulatives are used throughout the curriculum (e.g., games and puzzles) to enhance students' academic and psycho-social development. Students are encouraged to work in teams on projects and often are allowed to undertake special assignments on topics of their choice. Students are not graded numerically on the thinking skills materials (they are rated as excellent, satisfactory, or unsatisfactory in a descriptive report sent to parents every 2-3 weeks), but are graded on the rest of the curriculum. The Palm Beach County report cards, with letter grades, are sent to parents every nine weeks in order to give parents continuous feedback on their children's progress.

The accelerated and enriched curriculum also includes field trips, which are designed to expose minority students to a variety of community resources. The field trip experiences also serve as a springboard for class discussions and vocabulary development. Approximately 25-30 field trips per year per class are arranged by the Project Manager. Examples include trips to Planet Ocean (a local museum), the Everglades, and a robotics laboratory.

At the end of the fourth-grade year, students are tested for entry into the district's gifted program. Students are administered the WISC-R by a school psychologist. A bilingual psychologist tests Hispanic students. Those who either score two standard deviations above the mean on the WISC-R, or, have an IQ score of 130 are eligible to participate in the district's pull-out gifted program, which consists of two hours per day of course work designed for gifted students. The students who do not qualify for the gifted program return to their local neighborhood schools for instruction in the regular classroom.

Program Staffing

A variety of staff is needed to implement PGP. The core of the PGP staff includes a district-based Project Manager, nine fourth-grade project teachers, and nine full-time classroom aides.

The Project Manager coordinates all nine school sites, trains teachers, demonstrates strategies to teachers in their classrooms, develops curricular materials, helps to identify students, and conducts evening parent seminars.

Teachers are selected by the school principals and are chosen based on their experience in teaching at the elementary level and their enthusiasm for the goals of the project. Although certification in gifted education is not a requirement, some of the project teachers currently are certified, while others are working toward gifted certification. All are certified to teach at the elementary level.

All PGP teachers receive two days of training each school year in strategies for teaching thinking skills, conducted by Sandra Black in St. Augustine, Florida. Ms. Black is the author of the thinking skills materials used in the program. In addition, the Project Manager trains teachers by demonstrating instructional strategies in the classroom. He also provides training in the use of SOI as a test and as an instructional tool. The teachers in the program meet approximately once every two months as a group to share ideas and materials. Each project teacher works with one class of students, instructing them in an accelerated version of the regular fourth grade curriculum and in thinking and problem solving skills.

Classroom aides are required to have a high school diploma, and in order to instruct students, they must have at least one year of college. The aides receive training from the classroom teacher. Aides--present in every PGP class--perform clerical duties, assist in grading papers and in teaching, and provide transportation for field trips.

In addition to the core staff, principals are responsible for administering the program at their home schools. They observe classes at least once a week and evaluate teachers twice a year. Principals also control the budget for the program at their home schools. A district psychologist conducts testing for entrance into the gifted program in

May. A guidance counselor is available at each school with over 500 students and assists with identification of prospective students.

Parent Involvement

Parent involvement is crucial to the success of the program, as district staff believe that parent expectations must be raised before students will achieve at their maximum potential. Project staff meet with parents as a group three to four evenings during the year to discuss their children's progress, and to suggest ways that they can provide intellectually rich learning environments outside of school. Suggestions include visits to libraries and museums, and subscriptions to magazines and journals. Approximately 75 percent of the parents attend these meetings and involvement has increased over time. In fact, one principal reported that although there is little parent involvement in the school, there is a considerable amount among parents in the program. Parents also are invited to come into the classroom whenever they want, but few are able to, due to conflicting work schedules.

Funding and Program Administration

Funding. From 1980-87, PGP was funded through Florida's Alternative Education Program. When these funds became unavailable in 1987, support was obtained from the state's Dropout Prevention Program. The state's Dropout Prevention Program guidelines required that funds be spent on students in the fourth grade and above. As a result, identification of students moved from grade two to grade three, and special instruction from grade three to grade four. The state provides \$4,912 per year for each full-time student in the project. Total state funding for PGP, over the past two years, has remained constant at a level of approximately \$220,000.

Administrative Structure. Responsibility for the administration of this identification and curriculum program rests with the Palm Beach County Public School district. The Project Manager, Dr. Ronald F. Howells, reports directly to the Assistant Director for Special Education Programs, within the office of the Associate Superintendent of

Instruction. All data collection, evaluation, and reports regarding the program are conducted by the Project Manager.

PGP provides a preparatory curriculum for potentially gifted students who subsequently may qualify for the various gifted programs administered by the district. At the elementary level beginning in kindergarten, the district offers a pull-out program, where highly able students participate in separate learning activities for two periods a day. The elementary program varies with the individual teacher and principal, but instruction generally focuses on mathematics, science, and social studies. At the middle and secondary levels, there are special gifted courses, in addition to honors and Advanced Placement courses. The district currently is restructuring the high school gifted program to offer seminars for gifted students. This programming is offered in a state that mandates gifted programs for highly able students in grades K-12. The state does not specify a minimum amount of time devoted to gifted instruction, but encourages "an amount of time that meets students' needs."

Impact of PGP

PGP has been successful in preparing students to enter the district's gifted program, and in increasing student achievement. Each of these outcomes is discussed below, with the relevant supporting data.

Placement in the Gifted Program. As a result of the PGP program, the number of minority students entering the district's elementary gifted program has increased over time. At the inception of PGP, 61 minority children were enrolled in the Palm Beach County Gifted Program, which served approximately 1,200 highly able students. As of May 1988, 365 minority children are enrolled in the gifted program. Thus, the percentage of students enrolled in the gifted program who are minority has increased from five percent in 1980, to 16 percent in 1988. On the average, approximately 24 percent of PGP's students are admitted to the district's gifted program each year.

Student Achievement. PGP students have increased their performance on a variety of standardized measures. The results are presented below (Howells, 1986 and 1987).

- SOI. Program students take the SOI as part of the identification process in April of the third grade and again in May after a year in the fourth-grade program. While an average of one year's growth would be expected, program students showed an average of two year's growth on the following subtests during 1986 and 1987.

<u>SOI Subtest</u>	<u>Years of Growth Demonstrated</u>	
	<u>1986</u>	<u>1987</u>
Cognition	2.0	2.0
Memory	2.1	1.8
Convergent Thinking	2.3	2.4
Divergent Thinking	2.4	2.5
Evaluation	1.6	1.3

- WISC-R. The WISC-R is an IQ test scaled to the student's age. After one year, program students showed average gains of 16-30 points, which are significantly greater gains than those that normally are obtained.
- The Peabody Picture Vocabulary Test (Revised). This test measures hearing vocabulary for standard American English. In 1987, 81 percent of all PGP students achieved higher scores on the post-test after seven months of instruction, with an average gain for all classes of 13.1 points. In 1986, 82 percent of all PGP students achieved higher scores on the post-test after seven months of instruction, with an average program gain of 12.6 points.

Program Transferability

The PGP has been successful in developing minority elementary students' basic and critical thinking skills, so that they will be able to compete in the district's gifted program. PGP's philosophy has been to "cast a wide net" in identifying potential program participants, through the use of multiple identification measures. This process has helped to assure that minority students--who in the past have not participated in the gifted program--have an opportunity to be considered for further skill development.

This program has the potential of being replicated in a single school or throughout a district, as has been the case in Palm Beach County. The following elements are critical to the implementation of PGP. First, the provision of a one-year, self-contained, classroom intervention is necessary. This intervention must focus on developing students' thinking and problem-solving abilities, and on encouraging students to be independent learners. Second, a full-time project manager must be available to coordinate the program, demonstrate lessons and instructional strategies, and identify materials and training opportunities for teachers. Third, training in strategies for teaching thinking and problem-solving skills must be provided to teachers. Fourth, mechanisms must be available to encourage parental involvement in the program. Finally, the district must have a gifted program for elementary students in which program students can participate.

X. TRAINING OF ELEMENTARY SCHOOL TEACHERS
IN MATHEMATICAL THINKING
(Fort Worth, Texas)

Introduction

In an effort to increase elementary teachers' capabilities to identify able learners and instruct them in mathematics, a collaborative inservice education program is being conducted in the Dallas/Fort Worth, Texas metropolitan area. Under funding from the Sid W. Richardson Foundation and the U.S. Department of Education, staff from Texas Christian University (TCU) and the Gifted Students Institute (GSI) are working with four school districts to develop teachers' knowledge, skills, and confidence to teach elementary mathematics to able students. As one component of a five-year demonstration program known as the Pyramid Project, the Inservice Training in Mathematical Thinking program enables school districts to prepare teachers to address the multiple needs of elementary students who are at all levels of ability--from above average to highly gifted. This inservice education program has developed as part of the Pyramid Project--a research and development effort aimed at improving the education of highly able students.

Historical Development

The Pyramid Project. The Pyramid Project was created as a result of the recommendations from a four-year research study undertaken by the Texas-based Sid W. Richardson Foundation in 1981. The Richardson study identified existing programs for able learners nationwide, and developed recommendations for serving the needs of these learners more effectively. Through an extensive review of programs in 400 schools and over 1,500 school districts, the study noted two concerns: 1) the failure of existing programs to identify a representative number of highly able students, especially among disadvantaged populations; and 2) the fragmentation of existing services for able learners (Cox et al., 1985). The Richardson study recommended that entrance requirements to programs for the gifted and talented be broadened to cast a wide net for student participants. Further, the report expressed a

need for the creation of instructional programs for able learners that encompassed both enrichment and acceleration. The study noted that too often efforts to improve services for able learners have focused on the use of different approaches to teaching, rather than on increasing teacher knowledge of the subject matter.

In 1984, the Richardson Foundation funded the Gifted Students Institute, a private research and development firm in Fort Worth, Texas, to use the study's findings to develop a conceptual model for educating able learners. In the shape of a pyramid, the model presents processes for serving able students that correspond with students' diverse levels of ability. Three levels of learners are depicted in the pyramid. In the bottom and broadest layer are students who can benefit from enrichment activities in the regular classroom. The middle layer is composed of students who require some special separate classes to meet their learning needs. At the top of the pyramid is a small group of highly gifted or talented students who can be served most effectively in special schools with similar students. Spanning all levels of the pyramid is the need for appropriate pacing of learning, so that able learners may move ahead as they master concepts and skills (Gifted Students Institute, 1988).

The Pyramid Project and District Involvement. To implement this model, the Gifted Students Institute--with funding from the Richardson Foundation--began the Pyramid Project in 1985 as a five-year demonstration project to develop programs for able students in four Dallas/Fort Worth Metroplex school districts--Cedar Hill (in a suburb of Dallas), Birdville (in a suburb of Fort Worth), Arlington, and Fort Worth.

All four districts appointed teachers and administrators to serve on a steering committee. Then they began to gather information about the current status of services to highly able students to help determine the specific needs of each district. Under the Pyramid Project, highly able students could be served in a variety of ways--for example, a district could accelerate the educational process by moving gifted students to higher grade levels for certain subjects (the middle layer of the pyramid) or, by bringing advanced materials into the regular classroom (the bottom layer of the pyramid). To support these program-

matic options, each district worked out a plan to assess students' abilities and needs so that students could be placed properly and be exposed to opportunities for acceleration and enrichment.

Through cooperative agreements with GSI, the four districts agreed to develop and implement five-year plans to identify and serve able students in their schools. A critical component of each plan was staff development, one aspect of which was each district's participation in the Pyramid Project's Inservice Training in Mathematical Thinking program. In addition, the districts were to design instructional programs according to the pyramid model. For example, Cedar Hill focused on flexible pacing in developing its gifted programming. Birdville emphasized the base of the pyramid, and decided to serve its able students primarily through enrichment in the regular classroom. Arlington modeled its programming after the mid-section of the pyramid, and began to develop special classes for able students at the elementary and middle school levels. Although Fort Worth served its gifted students at all levels of the pyramid, it concentrated on refining the most prominent component of its programming--its special schools (i.e., the magnet program).

Development of an Inservice Training Program. A key component of the four districts' implementation of the pyramid model was the training required to prepare teachers to identify the types of able learners depicted in the pyramid, and channel them to appropriate types of learning opportunities. Teachers had to learn how to serve the broadest layer of students in the pyramid, by providing them with enrichment and acceleration in the regular classroom.

In order to develop one of the teacher inservice components for the Pyramid Project, GSI entered into collaboration with Texas Christian University in Fort Worth. The purpose of the collaboration was to design a training project for elementary teachers in the four districts that would equip them with the necessary skills to implement the pyramid model. Mathematics was selected as the subject of the training because it was considered to be the content area in which elementary teachers are usually the least skilled and confident. Kathleen Martin, a professor at TCU who had worked previously with GSI, was teaching

mathematics and science methods courses in teacher education and was interested in expanding her efforts through the Pyramid Project. After a series of meetings between GSI, TCU, and school district staff, an agreement was reached whereby Dr. Martin would implement a staff development program emphasizing knowledge of the content area in addition to the mastery of teaching techniques. In the spring of 1986, Dr. Martin initiated the program with a class of 25 teachers.

Program Operation

Design of the teacher training began with the assumption that many elementary teachers are "tied to the textbook" with its drill and practice methodology, and they do not understand fully the mathematical concepts that they teach (Martin, n.d.). Consequently, teachers sometimes are unable to design meaningful curricula, develop effective enrichment activities, or use unfamiliar materials to demonstrate mathematical ideas. Thus, the inservice training project was created in order to: 1) increase teachers' knowledge of the concepts that are taught in elementary mathematics and the problem-solving techniques that are utilized in instruction; 2) train teachers to assess students' abilities and place students in optimal learning situations; and 3) train teachers how to develop, test, and evaluate their own curriculum modules.

Key Program Components. To accomplish these objectives, TCU and GSI developed a three-component inservice training project. The first component is a one-semester, three-credit graduate-level course at TCU, in which teachers are instructed in elementary mathematics. The second is a summer seminar on the identification and assessment of gifted students. The final component is a series of workshops for instructing teachers in curriculum design and evaluation (Martin, 1986).

The graduate-level course is the core of the inservice training project. The course addresses fundamental themes in elementary-level mathematics, including: a) patterns, relations, and functions; b) numbers and numeration concepts; c) operations and computation; d) measurement, geometry, probability/statistics, and graphing; e) calculators and computers; and f) problem-solving.

One theme in the course that receives special emphasis is problem solving. Teachers are trained to use a problem-solving approach to develop students' mathematical thinking. They learn how to teach students to identify patterns, perceive relationships, and draw generalizations from data. Teachers also are trained to use concrete, physical objects to encourage students to abstract ideas and generalize concepts. Finally, they are taught to use analogies to describe mathematical relationships. Teachers' mastery of elementary mathematics and their effective application of problem-solving techniques is critical to the creation of an enriched environment for the able learner in the regular classroom.

The graduate course also trains teachers to develop curriculum modules for elementary students. The modules, which involve the use of problem-solving techniques and manipulative materials, typically consist of a set of lessons that explain a concept (e.g., measurement) through activities and experiments. Teachers are placed in teams to design modules that cover mathematical concepts. Through the module-design process, teachers increase their substantive knowledge of mathematics and learn how to use manipulatives, such as Cuisenaire rods, pattern blocks, multilinks, pentominoes, tangrams, and polydrons.

Once teachers acquire the knowledge and skills to teach mathematics in grades K-5, they participate in a two-day summer seminar in which they learn how to assess students' abilities--a key component of the pyramid model. Teachers are taught to use an activity-based assessment process to place able students in appropriate learning situations. In this process, teachers learn techniques to observe systematically students' participation in classroom activities, using structured observation instruments. These instruments are used to gather information about students' attention to tasks and their abilities to transfer concepts. Activity-based assessment is an alternative process to identifying able learners through the use of standardized written tests, in which the skills and talents of disadvantaged students often are not exhibited due to language and cultural deficits.

After learning to identify the able student, the teacher is taught how to devise multi-leveled activities that meet the needs of diverse student populations. Teachers are trained to distinguish between a child's need to learn to transfer the same concept to new situations and the need to move to a new conceptual level. Also, teachers are instructed in how to discern between the use of enrichment and acceleration activities with able students within their own classrooms.

For the third component of the inservice training project, teachers field test and evaluate the modules they have developed during the graduate-level course. Each teacher is responsible for testing two modules in his/her classroom over a one-semester period. At three after-school workshops scheduled at monthly intervals, Dr. Martin, the teachers, and the curriculum supervisors from each of the four districts discuss module implementation. The group evaluates the success of each module and proposes revisions. The final modules are spiral-bound and distributed to all participating teachers.

Teacher Selection

For each session of the inservice training project (a session consists of all three components and spans a 12-month period), the four participating school districts are allotted a percentage of the available slots based on district size. Each district is responsible for devising its own selection process, although districts are encouraged to use a method that favors teams of teachers from the same school or teams that involve both teachers and curriculum supervisors. Teaming is viewed as a vehicle for facilitating the exchange of ideas and increasing district support for the practice.

A total of 275 teachers have completed the inservice training as of Fall 1988. Sixty percent of the teachers are from the Fort Worth Independent School District (ISD), which is both the largest participating district and the one with the greatest number of minority and disadvantaged students. The student population of the district is 36 percent black, 24 percent Hispanic, three percent Asian, and 37 percent white. Forty-five percent of its total school population is enrolled

in the federal free or reduced lunch program; at the elementary level, the participation rate is 55 percent.

Program Staffing

Dr. Martin, a professor of education at TCU, develops and teaches the graduate course, leads the curriculum evaluation workshops, and conducts the two-day assessment seminar. Each participating district appoints a Pyramid Project liaison--either the coordinator for gifted and talented programs or a mathematics supervisor--to manage the selection process and monitor implementation of the modules. In addition, GSI staff act as advisors to the project.

Funding and Administration

Funding. The inservice training project has been supported by a variety of funds, including private and public sources. During the first year of the project (1985-86), 25 teachers from the Fort Worth ISD were trained. The district paid two-thirds of their tuition through a Richardson Foundation grant and the university remitted the remaining one-third. To conduct the second session of the project, TCU received an Education for Economic Security Act (EESA), Title II grant of approximately \$34,000 from the U.S. Department of Education that enabled the program to serve twice as many teachers. Under the one-year Title II grant, the Department of Education funded one-third of the tuition for each of 50 participating teachers, as well as the classroom materials. The remaining tuition fees were paid by TCU and the four school districts (a cost of approximately \$19,000). During the 1987-88 school year, TCU was awarded a second Title II grant, which enabled twice as many teachers to participate in the program. The Richardson Foundation will continue to fund the Pyramid Project through mid-1990.

Administrative Structure and State Context. GSI, as coordinator and fiscal agent of the Pyramid Project, oversees the entire inservice training program. Day-to-day monitoring and supervision of participating teachers is the responsibility of the Pyramid Project liaison persons in each of the four districts.

Recent state efforts to upgrade the teaching profession through the provision of more stringent teacher qualifications have caused Texas school districts and their faculty to take a greater interest in teacher training programs, such as that offered at TCU. In 1985, the state mandated a literacy test in reading and writing skills for all teachers in Texas. The new policy required that teachers who did not obtain passing grades would be terminated from their positions. In 1987, the state instituted a teacher appraisal system to supplement the literacy test. Under the system, every teacher in Texas must be evaluated by a peer, the principal, and a school or district administrator.

In addition to the above policies, the state now is revising its mathematics curriculum in order to make it consistent with the standards developed by the National Council of Teachers of Mathematics (NCTM). The state intends to introduce or improve the use of problem-solving techniques and manipulative materials in all its public school mathematics classrooms by 1991. Both the new emphasis on problem-solving and the renewed interest in teacher training have encouraged the need for the TCU inservice training project.

Program Impact

The inservice training project has been successful in increasing teachers' knowledge of mathematical concepts and their usage of manipulatives in the classroom, as well as improving their self confidence and attitudes toward mathematics. Each of these outcomes is described below, along with the relevant supporting data (Martin, 1988).

Increasing Knowledge of Mathematical Concepts. In 1987, 50 teacher participants in the graduate course were tested to determine the extent to which the training they received had improved their understanding of basic mathematical concepts. Teachers were asked to depict the meaning of arithmetic operations involving whole numbers, fractions, and decimals in pictures.

In the pre-test, the mean score of the teachers was 51.20 (out of a possible 70 points), with a standard deviation of 5.95. The scores ranged from 39 to 63. In the post-test, the mean score was 57.11, with a standard deviation of 6.44. When pre- and post-test scores were

compared using the T-test, the results appeared significantly different at the .001 level, making it highly unlikely that their differences could be attributed to chance.

Increased Use of Manipulatives in the Classroom. Teacher participants also were surveyed to determine the extent to which the training had caused them to use manipulatives in the classroom. At a follow-up meeting--approximately six months after they had completed the graduate course--teachers were asked to compare their use of manipulatives before and after taking the course.

The survey results showed that before the course, 82 percent of the teachers had used manipulatives less than 25 percent of the time, and, that only three percent had used them more than 75 percent of the time. After the course, 48 percent of the teachers reported using manipulatives in their classes 50 to 75 percent of the time, and 28 percent reported using them more than 75 percent of the time.

Improvement of Attitudes Toward Mathematics. Pre- and post-tests of attitudes toward mathematics were administered to teacher participants to measure their perceptions about the program, such as pleasant/unpleasant, active/passive, and valuable/worthless. Scores showed significant positive change with respect to teachers' feelings regarding "secure/insecure"--significant at the .001 level, "comfortable/uncomfortable," and "afraid/unafraid"--significant at the .005 level.

Program Transferability

The Inservice Training in Mathematical Thinking program has developed as a collaborative model for meeting the needs of elementary mathematics teachers who work with highly able students. As a model, the program has potential for being implemented in other school districts with similar needs. The following conditions are required for the replication of the program: 1) a workable model of collaboration, including the participation of an institution of higher learning; and 2) a source of funding that allows for extensive training over time. Each factor is described below.

Collaborative Model. Crucial to the success of this inservice training program has been the willingness of the four school districts,

GSI, and TCU to work together. Each participant has taken a distinct role in either designing, funding, or managing the project.

It is important that one member of the collaboration team be a college or university. An institution of higher education must agree to offer a full semester of graduate credit-bearing instruction in the substantive elements of mathematics, as well as in effective techniques for teaching highly able students.

Funding Source. Also necessary to implement this model is the availability of an outside funding source or a long-term commitment by a district to finance the teacher training. Funds must support the operation of all three project components, including the cost of additional faculty, if large numbers of teachers are to be trained at one time.

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